The Builder.

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Selected Design for Municipal Buildings, Bath.—Mr. J. M. Brydon, F.R.I B.A., Architect ..... *Extra Large Ink-Photo.*
Plans of New Municipal Buildings, Bath ..... *Two Single-Page Photo-Litho's.*
Mosaics in St. Mark's, Venice.—From Drawings by Mr. Arthur C. Blomfield..... *Two Single-Page Ink-Photo's*
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The Institute Suggestions for a Building Act.

THE Institute of Architects, as before noted, has issued a series of suggestions for a draft Bill for the codification and amendment of the Metropolitan Building Acts. These suggestions were prepared in 1890-91 by the Practice Standing Committee, and were considered and adopted by the Council of the Institute on the 30th November, 1891. The existing building regulations are printed in one column and the proposed amendments or insertions in a parallel column, for more convenient reference and comparison.

In the course of some introductory remarks, it is suggested that the details of construction, which are subject to variation from time to time from different causes, but more especially on account of new inventions in building material or new methods of construction, should be omitted from the body of the Act and placed in schedules as bye-laws which can be altered from time to time as may be thought desirable, without interfering with the general working of the Act or necessitating fresh legislation. This suggestion is so entirely in accordance with common sense, and the necessity for such a provision has already been so decisively shown in various instances, that we may almost regard it as a foregone conclusion in connexion with any fresh legislation on the subject of building. Another general suggestion which is made, not in the introductory sentences, but in its place in the draft Bill, is that the new Act should not be divided into parts—"The first part relating to the regulation and supervision of buildings; the second part relating to dangerous structures" &c. (Act of 1855), as such division "serves no useful purpose." This we do not feel so sure about. The more an Act for very multifarious provisions is classified, the easier is it for those who have to obey it to find out what is required of them in any special case, and that is certainly a "useful purpose."

Coming to the detailed suggestions of the raft, of which we only propose to notice a few of the most important, we are reminded on the second page of one of the curious oversights in our existing legislation, viz.: the absence of any direct or authoritative definition of a "building." "Building owners" are referred to, but with no definition of what it is that they own; "public buildings" are defined in reference to the qualifying adjective "public," but not in reference to the noun which it governs. The Institute of Architects therefore has the honour of attempting the first definition of a building for the purposes of legislation. This is the definition:—

"Building includes every erection comprising a cubical space defined by walls, piers, posts, or other structures, and a roof or other covering, whether such erection is wholly enclosed or not, and whether it is fixed on permanent foundations or not, and of whatever materials it is constructed, and for whatever purpose it is used or constructed or adapted (but so that this interpretation be not construed so as to exclude from the application of the term building as used in this Act any erection that would have been determined to be a building according to the true construction of this Act if this interpretation had not been inserted in this Act)."

The first part of the definition seems well worded and sufficiently comprehensive, and by the sentence "whether fixed on permanent foundations or not" any dispute about the nature of the foundation is no doubt barred. Still, as there is a distinct reference to "permanent foundations" and the reverse, we should have looked to find under the proper heading some definition of "permanent foundations," an expression which does not in itself convey a very distinct idea. But all we find under foundation is,

"Foundation shall mean that on which the walls piers and other supports of any building or other structure rest."

This is better than the sentence of 1878—"The term foundations shall mean the space immediately beneath the footings of a wall," which is very loose, inasmuch as a foundation is certainly not a "space." The word "other," however, is superfluous, because in the Draft Bill "structure" is already separately defined from "building" as follows:—

"Structure includes any wall or other erection and anything affixed to or projecting from any building wall or other erection."

It should have been "any building or structure," not "or other structure." That is only a detail of wording. Still, such inaccuracies of wording sometimes lead to disputes. And we should certainly wish to understand what a "permanent foundation" is, or rather what a "not permanent" one is.

But there is a more serious discrepancy between the above definition of a building and another clause in the draft; page 12, "Foundations and Sites of Buildings." We there read that

"Every building shall be enclosed with walls constructed of brick, stone, or other hard and incombustible substances, and the said walls shall rest on the solid ground, or upon a bressumer of fire-resisting material, or upon other solid substructure."

If every "building" shall be enclosed with walls constructed of brick, stone, &c., what becomes of the definition of a "building" as an erection "comprising a cubical space defined by walls piers posts or other structures, *whether such erection is wholly enclosed or not?*" The framers of the draft seem to have forgotten on page 12 what they had said on page 2. We presume what they meant to provide is that a building, *when it is enclosed*, should be enclosed "with walls constructed of stone, brick," &c; *i.e.*, it should not be enclosed with timber or lath and plaster walls. But as the wording stands the two sentences are contradictory.

What again is the value of that cunning-looking parenthesis appended to the clause defining a "building"? The clause aims at exactly defining a "building," and then follows a *caveat* that nothing should thereby escape being considered a building because it does not come under the terms of the definition. Then what is the use of the definition? Such cautionary clauses are only necessary when an Act is worded in loose and broad terms; but where there is an intention to define accurately, it is a confession of failure to fall back upon a vague expression about the "true construction of this Act." The definition is the "true construction" if it is a full precise definition. In this case we think it is; only some other clauses do not agree with it in terms.

To the original definition of "public building" the Draft adds some other classes (public

bath-house, public gymnasium, &c.), but covers the whole, like the 1855 clause, with a general phase, "constructed or adapted to be used ordinarily or occasionally for any other public purpose." "Ordinarily or occasionally," it will be seen, is an important and indeed necessary addition.

"Sky-sign" is retained as at present in the definitions, but there appears a new definition of "wall sign," which will include the monstrous lettering often fixed upon buildings; and in a clause on page 15 we find it provided that no advertisement shall be set upon the face or in front of the external wall of any building in any street "except on frames or other construction of fire-resisting material," in "accordance with by-laws to be made by the Council in pursuance of this Act"; and the wholesome clause is added that "no such advertisement should be fixed to diminish the light from any habitable room." That would put an end to the late Mr. Barnum's compliment to us, that England was the only country he had been in where people were content to shut out the daylight from their dwellings for the sake of advertisement.

To return to the definitions, that of domestic building (a difficult expression to define) is well considered:—

"Domestic building shall mean (Class A) a building used, constructed, or adapted to be used wholly or principally for human habitation; (Class B) an outbuilding or stables appurtenant to a building of Class A or C whether attached thereto or not; and (Class C) a building used or constructed or adapted to be used wholly or principally for business offices or shops or any other building not being a public or a warehouse or domestic building of Classes A or B."

A "Habitable building" is a room in which a person passes the night, as distinct from a "Living room," "used for human occupation by day," which includes kitchen, scullery, and pantry (not larder). A separate definition of a "flat" is also given, and a definition of the often contested word "storey," which is full and satisfactory. The suggested definition of "site" is also better than that of 1878.

"Fire-resisting," in relation to material might perhaps have been relegated to a schedule. The definition includes concrete and allied materials, brick, terra-cotta and natural or artificial stone; iron, steel, or bronze, and "other material of similar character which the district surveyor may approve; and, for bressumers and posts, wood beams" of not "less depth and width in any part than 10 in." Should there not have been a difference made as to some kinds of woods? An oak post in this respect is a very different thing from a fir post, for instance. And it may be questioned whether stone should be included under "fire-resisting materials." It does not burn, it is true, but it is one of the first things to crack and become thereby useless for any purpose of upholding the structure.

In the list of buildings to be exempted from the operation of the Act one or two important modifications are suggested. The Bank of England is left exempt, but the exemption "shall not include any branch of such Bank erected in any other part of the metropolis." The Draft proposes the entire omission of the clause which exempts "the Inner Temple, the Middle Temple, Lincoln's Inn, Gray's Inn, Staple Inn, Furnival's Inn, or the close of the collegiate church of Saint Peter, Westminster."

The clause of 1855, which exempts any building "not exceeding in height 30 ft. . . . and distant at least eight from the nearest street or alley, and 30 ft. from the nearest buildings," has an important addition providing that no such building shall be exempt where it is erected on any estate laid out for building where it is intended to erect other buildings or to let or sell any ground "other than to the owner of such building" (not quite grammatical) "within the said distance of 30 ft." The exemption of greenhouses is proposed to be limited to those which do not exceed in area 300 ft., measured to the outside of the framing.

Another section of exemptions is to apply to the roofing over of open yards enclosed on one or more sides by buildings, and no yard so roofed over shall be deemed to be a building within the meaning of this Act. Then follows another clause which appears to clash with the definition of a "building" before referred to: "Sheds open on one or more sides may be erected if the roof be covered with fire-resisting material," &c. Now we look in vain for any definition of a "shed," and the words here used are equally applicable to a "building," considering that by the previous definition a building may be supported by "posts" and need not be enclosed at the sides to come under the definition. In that case what differentiates a "shed" from a "building"? Following this is a provision that external metal flue-pipes exceeding 10 ft. in length shall be inspected by the district surveyor every five years, and if in his opinion they are safe, a licence shall be granted for another five years.

A clause in regard to the alteration of buildings is suggested, providing that any exemption or privilege of building shall remain in force only so long as the building is retained for the special use on account of which or in respect of which it was exempted; and another important one follows in regard to the restoration of old buildings, which provides that when it is necessary to take down an ancient building and re-erect it in a more secure manner, then with the written consent of the Council such building may be re-erected as it was before, even if in contravention of the terms of the Act: it remains, in short, legally an ancient building, though newly erected; a provision which might certainly become necessary occasionally.

Clauses are suggested in modification of the existing clauses as to recesses in party walls, which define better what was probably intended but not properly expressed by the framers of the 1855 Act, stating distinctly not only that the backs of such recesses shall not be of less thickness than thirteen inches, but that "in no case shall the back of such recess be within four inches of the centre of the said wall." The loose wording of the old act in this respect has been the cause of much dispute and of much licence by builders who chose to construe it the way that suited their convenience. The clause as to chases in party walls is re-worded to a similar effect. Considerable additions are suggested to the clauses as to carrying up party walls above the roof; one dealing with a point hitherto overlooked, that where eaves or gutters not of fire-resisting material project beyond the face of the building, the party walls shall be corbelled out to an equal extent, and carried up to the height required by the Act as to other parts of the wall.

The most important additions after this are in regard to provision against danger from fires, one clause suggesting that the floors of every corridor, hall, or passage, as well as the stairs, in any building having a floor area exceeding three thousand six hundred square feet or containing more than fifty thousand cubic feet, shall be of fire-resisting material, which may however have wooden flooring on it "without an air space between." There follows on this an important clause on "egress from certain buildings," applicable to any building containing flats which has a greater floor area than five thousand feet, or where the greatest distance from the end of any corridor to a staircase in such building exceeds sixty feet, or wherever any warehouse contains any flat or other habitable rooms,—in all such cases the staircase shall be carried up to the roof and a portion of the roof, in no part less than 6 ft. wide, laid flat and with a railing for safety, to give access to another staircase of fire-resisting material; both such staircases to have communication with the street to afford means of egress in the event of fire. This is an important suggestion, and if carried out would make a great difference in the percentage of deaths from fires in inhabited buildings.

The portion of the Draft Bill now printed and circulated among Members of the Institute is that which deals with construction. The Practice Committee are still, we understand, at work on the subject, and in the further portions of the existing Acts many changes will be required "consequent on the foregoing revision of the first part as well as on the merits of the sections themselves." The "first part" means, we presume, the portions of the existing Acts which refer to the regulation and supervision of buildings, which formed the "First Part" of the Act of 1855: but it is not very clearly expressed. As far as the Institute revision has gone it appears to contain many excellent suggestions and to form a very good groundwork for a new Act, but like the existing Acts it fails sometimes from lack of clear definition in wording, which is a very important point in legislation dealing with a very complicated subject. The definition of a "building" certainly requires either revision or the modification of those clauses which at present clash with it. As the draft now stands there is room for a good deal of misunderstanding on the subject.

THE ARCHITECTURE OF THE TEUTONIC ORDER OF KNIGHTS IN PRUSSIA.

BY THE BARON DE GEYMÜLLER.

MEDIÆVAL castles, on the Continent at least, have been hitherto far less than other classes of monuments of the past the object of investigation by architects as well as by archæologists; no doubt, besides the ruined state to which wars and revolutions have generally reduced them, because, as dwellings and as fortifications many centuries old, they differ too much from the requirements of modern civilisation to be very suggestive to those who are in search of some inspiration for their own works.

But as documents for the history of architecture and civilisation, these habitations of a pre-eminent class of the nation are certainly important and worthy of consideration. It may, therefore, also interest some readers of the *Builder* to have their attention called to some recent German books treating of these subjects. An attentive examination of the two volumes published by Herr Steinbrecht,* a Prussian Government Architect, will soon show that even from their architectural merit, in the strict sense of the word, the buildings of the Teutonic Order offer not only considerable variety, but form an unexpected manifestation of Mediæval architecture, the importance of which, if I dare to judge from my own case, has not been suspected hitherto, even by the few who might have visited the celebrated Marienburg. The strict rules of a congregation and Power, at once military and religious, soon lead to a system and order which make their monuments differ considerably from the strongholds erected for the abode of feudal families.

The Teutonic Order was the third of the Christian Orders of Knights. Its origin was in 1190, during the siege of Acca, when citizens of Bremen and Lubeck, under the protection of Count Adolph, of Nassau, united with the brothers of the German hospital, which since 1128 existed at Jerusalem. Their object was twofold; the nursing of sick pilgrims and the defence of the Holy Land. Acca was the first home of the Order which received the same rights as the Templars and Knights of St. John. It had two classes of members; Knights and merciful brothers, later also priests. The Order under the fourth master, Hermann von Salza, the greatest statesman of the thirteenth century, became very powerful, had numerous possessions over Germany, Hungaria, Italy, and Sicily. Its help was then requested by the Duke Konrad of

* "Thorn im Mittelalter. Ein Beitrag zur Baukunst des deutschen Ritterordens." Berlin: Julius Springer, 1885. In folio, 45 pages of letterpress, with 39 illustrations and 14 plates on copper.

"Preussen zur Zeit der Landmeister, Beiträge zur Baukunst des Deutschen Ritterordens." Berlin. 1888. In folio, 128 of letterpress, and 184 illustrations.

Massovia, against the heathen Prussians. The Pope and the Emperor Frederic II., being favourable to this design, and the Culmerland having been assigned as the seat for the Order, the Landmaster, Hermann Balk, was sent (1230) with about ten Knights to begin the contest, which ended 1283 with the victory over the Prussians and their conversion.

If this undertaking did not, like those of the Orders in the East, meet with a resultless end, it is due to the merits of the Teutonic Order, which completed the conquest, directed the colonisation of the country, founded towns and villages, and understood, for a long period, how to direct and order wisely the inner and outer affairs of their dominion, which, at the time of its greatest power, extended from the Oder to the Gulf of Finland. To them also Prussia is indebted for the embankment of the Vistula and Nogat.

Some buildings, it is true,—for instance, the celebrated Marienburg in Prussia, the doms of Königsberg and Frauenberg, the castle of Heilberg,—had been the object of older as well as more recent publications. The latter, due to Herr von Quast, had the merit of suppressing, by the minute examination of the Marienburg, the prevailing erroneous opinions. One serious and important error continued, however, to mislead opinion,—viz., that the principal architectural activity of the Order was not anterior to the middle of the fourteenth century. This idea remained at the bottom of all criticisms, and led to the belief that no remains of earlier buildings of any importance were to be found any more.

Professor Töppen, however, lately proved, by a series of documents concerning the castles of the Order, as well as those erected by bishops, that if the Knights made a considerable use of temporary constructions of wood and earth, wherever they had obtained a solid footing, it was stone, and consequently monumental architecture, that they employed. Calling the attention to an apparent contradiction existing in the remarks of Herr von Quast, according to which the oldest parts of the Marienburg anterior, as generally admitted, to the year 1300, were far superior, architecturally as well as technically, to the parts that had been added since by Dietrich von Aldenburg (1335-41), he expresses the confident hope that a proper study of the hitherto neglected residences of the Order would lead to the discovery of important remains of that earlier period, history teaching that the oldest settlements of the Order are to be looked for on the border of country on the right of the Vistula and on the shore of the Haff, but, above all, in the Culmerland and in the city of Thorn.

It must, therefore, be considered as a very happy idea of the senate of the "Technische Hochschule" at Berlin to propose in 1881, as theme for the Louis Boissonnet Prize, an attentive study of the buildings erected by the Teutonic Order in East and West Prussia, and principally those of the town of Thorn. These countries have been hitherto little explored.

But before undertaking the minute study of the monuments at Thorn, Herr Steinbrecht thought it advisable to visit throughout the country the remains of the principal establishments of the Order, drawing their plans and details, obtaining thus a precious source of instruction.

These preliminary informations form part of the first volume, whilst the second volume contains a closer investigation and the exact drawings of the more important of these monuments erected during the period of government of the Landmasters. Among these, Culmsee has a Duomo of considerable effect, and a rich choir, partly of Romanesque style. Culm in its fortifications and by the importance of its churches reminds us of Thorn; its celebrated castle, the Althaus, distant one hour, was the first residence of the Landmasters, demolished in the last century.

Schwetz in the low country, accessible to the inundations of the Vistula, with a fine round angular tower and battlements.

Grandenz, from its elevated situation, was one of the strongest and most important castles; of this, one tower, the interesting Klimmek, alone remains.

From Grandenz, the three castles of Engelsburg, Rheden, and Roggenhausen are easily visited. The second of these, from its picturesque outline, its artistic value, its origin in the best period of the Order, and its never having been disfigured by later additions, is one of the principal places for the study of the architecture of the Order.

Riesenburg and Schöneberg are castles of the Bishop and the Chapter of the Duomo of Pomerania. Golub, situated very much out of the way, has changed little, offers numerous wood houses with low flat-arched arcades or loggie.

At Soldau begins the territory of the ancient Duchy of Prussia, and its buildings bear a different character. They belong to the later period of the Order, show a cheaper and more common art, have generally been transformed for modern use, and thus offer less interest to archæologists, but, on the other hand, by their often well-preserved general appearance, give an idea how grand an impression was produced in former days when the country, once possessed by the Order, was covered by many hundreds of such castles.

The Neidenburg, though erected for a mere bailiff, rises like a gigantic residence over the country. Heilsberg, in the heart of Ermland, is picturesque like a Thuringian place. Its castle, principal residence of the Bishop, has been sufficiently illustrated by one of H. von Quast's publications, and, though since then several changes have taken place, it is the castle in Prussia, which inside and outside, and by the preservation of the outer castle and surrounding parts, has best retained the noble and striking features of an "Ordensburg." The inner court has a beautiful Mediæval double-storied cloister.

The castle of Rastenburg is only small, but its St. George church rises like a citadel on the highest point of the town.

Barten, of considerable extent, well preserved in its general features, is of a late character, and from its chapel and other parts seems never to have been quite finished. More to the east one castle rises close to the other. Their transformation has seldom left more than the general plan, as is the case at Tapiau and at Tilsit, or some mere details or vaults, of archæological interest. Ragnit at least shows, besides its great extent, the energetic design of the façades.

In the border of land extending along the Frische Haff, once distinguished by a series of magnificent castles, such as those of Elbing, Brandenburg, Frauenburg, Balga, Königsberg, everything has been destroyed. At Lochsted alone a group of small rooms, elegantly vaulted, most likely the dwelling of its former lord, is left, likewise a chapel of extreme delicacy in design as well as care in execution; the terra-cotta ornaments of the old door can only be compared to those of the "golden gate" at Marienburg.

This exploration clearly proved that the castles of the south-east region belong, without exception, to the same and more recent epoch,—the second half of the fourteenth century. But in the oldest settlements, in the "Culmerland," along the Vistula and the Haff, differences of style corresponding to a period of about a hundred years backwards could be observed. Generally, it was not possible to fix the dates of the monuments in an isolated situation, on account of the want of documentary information. On returning to Thorn, a remedy was found for this latter deficiency. The monuments of this town unite all the features observed separately in the castles of the places, and a rare abundance of documents given by the archives at the Town-hall enable one to fix the dates of building even unto the very details, and thus fixed points of comparison for dating the monuments all over the country were safely obtained, and an important step made concerning the historical as well as material knowledge of the architecture of the Teutonic Order.

In former times the valley of the Vistula was a broad, marshy, impracticable ground. In one single spot the higher banks approach on both sides of the river, an island rendering the passage easier. Here the Knights founded their castle, and the town of Thorn, as a base of operation for the conquest of the Culmerland. It was their first settlement beyond the Vistula.

From the very beginning the Order aimed at establishing a solid territorial dominion. For this German immigrants were necessary, the rights of the colonies settling under the protection of the castles were fixed 1233. Thorn and Culm, the two first towns, received the Magdeburgh municipal rights. Already (1264) the number of new colonists was so considerable that a new town (the "Neustadt") had to be founded outside the existing one, henceforth called the "Altstadt."

In the course of the fourteenth century Thorn became the first town of Prussia, the point of transit between Poland and the Baltic, and a member of the Hansa, and was called "The Queen of the Vistula." The old parish churches, the town-hall,—no more sufficient to satisfy the new circumstances,—had to be modified as well as amplified. After the defeat of the Order at Tannenberg (1410), and forty years of subsequent struggle, West Prussia was subsequently lost, and Thorn, after the so-called "war of the towns," renouncing its ties with the Order, became the chief head-quarters of the Prussian League, and put itself under the protection of the King of Poland. The peace of 1467 freed it from the hated yoke of the Order. From this period date the greater elevation given to the nave of St. John, and the building called "Junkerhof," erected on the place occupied until 1454 by the "Burg."

The return of Thorn to Prussia in our century has given new importance to this city, now the chief bulwark of the German Empire towards the east, a singular illustration as to the judicious choice made by the Teutonic Order of Thorn as a strategic situation.

The fortifications of Thorn are the oldest of the lower Baltic region, and are remarkable from the exceptional dimensions of their profile, gates, and towers. Herr Steinbrecht attributes this fact to the habits contracted by the Order in Syria. This opinion seems confirmed by another constant disposition in all the buildings of the Order. The ditch does not begin at the foot of the principal wall; it is separated from the latter by the "Parcham." This name is given, in the buildings of the Order, to a somewhat lower terrace all around the walls, protecting these against mining. Its battlements command the ditch and form a first line of defence. It comes from the προτειχυσμα of the Byzantine engineers, which had been adopted in Frankish buildings in Syria. It was only by means of ancient views of the town that Herr Steinbrecht was able to restore the main features of this important castle. It rose on the right bank of the Vistula, at the upper end of the town, and outside its walls, beginning at the broad ditch of the Altstadt. Since the creation of the Neustadt, with its fortifications, the castle came to be partly situated between the two towns, preserving, however, an open space on the banks of the river, forming a new outer fortified precinct of considerable extent. The only parts of the castle actually existing are the "Dansker,"—a peculiar sort of tower, the explanation of which will be given further on,—and the building erected across the ditch containing the weir and all the contrivances for maintaining the water of the small river Bache in the ditch around the town and castle, when risen to the desired level. This castle contained seven outer courts or "Vorburgen," and, as Mr. Steinbrecht rightly observes, the Neustadt itself can be considered as a sort of outer "Burg" It was the first castle erected by the Order, begun in 1236, when the town of Thorn, founded five years before, was removed to its present site. When the war between the allied towns broke out, after a brave defence, it was

stormed by the citizens on February 7, 1454, and burnt down. This was the signal for the rising of the whole country.

The other buildings of Thorn which are the object of a complete description are the parochial church of St. John-in-the-Altstadt, its successive transformations being illustrated by four woodcuts, and St. Jacob-in-the-Neustadt, erected at the cost of the Order. In the former the three naves are equally high. A chromo-lithograph shows the effect of the green and yellow glazed ornaments of the choir of St. Jacob, with a frieze composed by an inscription with ornamental letters. St. Mary, the church of a Franciscan convent, shows original specimens of brick architecture.

The Town-hall (Rathaus) of the Altstadt, and several private houses, combine to give a very interesting idea of the buildings, which, like the whole town, owed their erection to the Teutonic Order, or to the impulse it had given.

In his second book, Mr. Steinbrecht describes twenty-two castles of the Order, in the districts of Culm, Pomerania, Natangen, and Samland. He deserves special credit for the clear and easy way in which he gives us, first, such historical and geographic informations as are necessary for the intelligence of the reader, the greater number of which are likely to feel otherwise strangers in the centres described.

The principal events of the history of the Order, before and since the conquest of Prussia; the state of the country before the arrival of the Knights; the history of the conquest, accompanied by two maps, are given in short, well-written chapters, and the volume finishes with two very interesting tables, the first giving the chronological succession of their foundation as strongholds of a temporary character, in earth and wood, and the dates of their transformation into permanent buildings of brick and stone. The second gives a comparative view of the composition of each castle, its superficial area, the dimensions of its most important elements, the character of its principal tower, and the position of the Dansker.

In some cases the outlines of the three castles, which generally composed the residences of the Knights, are preserved, or at least well recognisable, as is the case with Engelsburg and Balga. The outer castle, Vorburg, is the largest, then comes the middle castle (Mittlere Haus), finally the upper castle (Oberste Haus', Convents Haus).

The castles, according to their importance, were commanderies, district commanderies, and residences of the Landmeister, or governor of the whole dominion. Unfortunately, the palace of the latter, in the castle of Elbing, and since 1281 the principal of the Order, has totally disappeared. Since 1309 the "Hochmeister" of the Order established his residence in Prussia, instead of the Landmeister, and Marienburg became his abode. This celebrated castle is intended by M. Steinbrecht to form the subject of a separate monograph.

The strongholds which the Order erected in the conquered countries were destined, besides their strategical intent, to offer a shelter to the colonists. Under the protection of its walls, towns arise, the castle becomes the citadel of these cities, and it was the interest of the Knights to further order and prosperity of the new communities.

The flat configuration of the country certainly facilitated the development of the regular plans which are one of the striking features of these castles. Some are situated on the very shore of the sea, others on rivers or near lakes. When the position chosen for the castle offered an elevation of the ground, the outlines of the three different castles are quite irregular, following the lines of the ridge of the plateau. This is the case, for instance, at the Engelsburg, at Balga on the shore of the Frische Haff, and at Roggenhausen. In this latter case the area of the Schlossberg was sufficient to contain the second castle, and in it the upper house, which could receive a regular square plan; we see the same disposition at Mewe and Popau. This fact, combined with the circumstance that out of the twenty-two castles twelve show regular plans in the shape of a square, clearly illustrates that this disposition was considered by the Order as the best, whenever circumstances permitted its adoption. The square plan of Reden, preceded by two outer castles of less regular form, confirm this idea. At Lochsted, the upper and the middle castle each are on a square plan, separated by broad ditches from each other.

Generally inside the walls the four sides are surrounded by the different buildings, leaving a court-yard of regular form in the centre* buildings seem to have occupied only the two opposite sides of the square, being connected by lower galleries and the upper battlement.

In many cases the angles of the square are strengthened by four square towers, only slightly projecting, but rising to a moderate height above the battlement. Besides these towers sometimes a principal more important tower is added. At Reden it is octagonal and situated in one corner just behind one of the angular towers, which it commands by a far superior height. At Strasburg and at Mewe it takes the place of one of the four angular towers, whilst at Golub it was circular, and situated outside the square, in a diagonal position, quite close to one of the angular towers.

These hesitations as to the position of this tower, which may be considered as the doujon of the upper castle, in itself a sort of doujon, are worthy of notice. A very interesting example of such principal towers is that of Strasburg in the district of Culm. It is octagonal, of more than 10 mètres in diameter, 55·5 mètres high, with eleven stories inside, crowned by two terraces with battlements, the upper one of lesser diameter disposed around the conical roof. Strasburg shows another tower of an entirely different character erected over the Neumarker Gate in the town wall, showing above two storeys with windows one of those high gables frequent in Northern Germany, with several retreating storeys, separated by buttresses, ending in pinnacles, and dividing interspaces decorated like high and narrow windows. Roggenhausen exhibits another type of towers over a doorway. It is square, of imposing dimensions, of a simple but noble architecture. From what remains of the principal tower of Grandenz Castle, called "Der Klimek," it must have been interesting example of the round type.

Another disposition considered as belonging exclusively to the castles of the Teutonic Order is the so-called "Dansker," consisting in an isolated square tower, at a certain distance from the walls of the upper castle, situated on the slope of its eminence, or in the lowest part of the neighbourhood, opposite the side of the principal attack, and sometimes (as at Thorn) built on four piers, between which passes the running water coming from the water-mills. This tower is connected with the castle by a narrow corridor between battlements passing over lofty arches. For a considerable time the exact use of these "Danskers" seems not to have been fully understood. It was believed that they were intended to permit a final escape by the chimney-like descent they contain, or to attack from behind the enemy fighting near the foot of the castle-walls. But Mr. Steinbrecht tells us that their real use was much more prosaic, and that Professor Töppen† has proved them to have contained the privies destined for the numerous inhabitants, which the Knights were desirous of isolating as much as possible from the dwellings. Various examples of this disposition are those at Thorn, Lochstedt, Marienburg, &c.

In the second publication we notice, amongst the most interesting features, the plan of the town of Culm, showing all the streets at right-angles and equidistant, like many ultra-modern cities.

In considering the composition of the upper castle in the greater number of these strongholds, we feel that their architectural fundamental idea is similar to the peculiar character of their builders: warriors and monastic brothers at once. Unless admitting that the generally square form of the outer walls be some reminiscence of the Roman Castrum, it seems more natural to derive it from the square form of the cloister of the convent, around which are grouped chapel, chapter-room, refectories, dormitories, the dwelling of the commander, and so on. And consider the similitudes of composition existing between a great number of these castles, and forming, if we do not misunderstand the illustrations of Herr Steinbrecht's volume, a type of peculiar character, we feel inclined to ask whether the architects who built them did not belong themselves to the Order, following precise rules and principles of their own, and of experience far superior to what could be met with in the architects of Northern Germany.

The system of decoration of the monuments erected by the Teutonic Order is closely connected with the style adopted in the marches of Brandenburg, and illustrated many years ago by the publications of Professor F. Adler.* However, if we are not mistaken, the monuments of the Order, besides the special types of its castles, generally show a nobler and more powerful scale of proportions with greater elegance and signs of a more refined taste, which very likely are due to Southern and Arab influence which some way or other the Order contrived to preserve in the earlier period, at least, of its monumental creations. This seems to be also Mr. Steinbrecht's opinion, and he considers the examples of inscriptions with ornamental letters employed as decorations as a reminiscence of Arabian art hardly met with in Western Europe, except in the buildings of the Teutonic Order. (Vol. i., pl. ix., and Vol. ii., figs. 166 and 168).

The materials in which these monuments are erected, generally speaking, are bricks and terra-cotta. Popau, however, is built in random blocks of granite in layers from 50 centimètres to 1 mètre in height, with ornaments of hewn stone. In many cases the walls are decorated by various courses of glazed bricks,—Reden, Strasburg, Mewe, and, particularly, the Marienburg show examples of this system. The details of terra-cotta are generally obtained from moulds, and similar to those adopted in the marches of Brandenburg and northward, generally red alternating with green or yellow. Some of these forms, according to their disposition, permit of various patterns, for instance, in the village church at Balga. In other cases, according to Mr. Steinbrecht, the beautiful details of the Marienburg and some at Lochstedt have been obtained by a process described by him on a previous occasion,† consisting in artificial blocks of clay in which the ornaments are sculptured when dry and before being burnt.

These Italian and Arabian features can, I believe, nowise astonish if we reflect that the conquest of Prussia was begun under the Grand-Masterdom of Hermann von Salza. This high-minded and noble statesman and warrior was the friend and constant counsellor of the Emperor Frederic II. Both, it is well known, resided more in southern Italy and Sicily than in Germany. Their constant intercourse with the East, and Frederic's Body Guard of Saracens, suffice to explain the source of such influences, which may be supposed to have been even stronger in the earliest monuments, the Althaus, Culm; and Elbing, the capital of the New Dominion and the first Residence of the Landmaster. Their total destruction must be considered as an irreparable loss, the more to be regretted since it becomes evident

* As at Popau, Leipe, Schönsee, Golub, Reden, Strasburg, Elbing, Mewe, Brandenburg.

† Töppen, "Geschichte von Marienwerder," page 190, and Cohausen, "Bonner Jahrbücher," xviii., 22-25.

* "Mittilalterliche Backstein-Bauwerke des Preussischen Staates," in fol. Berlin, 1860, and "Der Ursprung des Backsteinbaues in den Baltischen Ländern," Berlin, 1884; in 4to.

† "Centralblatt der Bauerwaltung," Berlin v., p. 391.

that, besides all the remarkable features alluded to, the superior qualities displayed in the composition of all the dispositions of the plan of these convent-castles are, perhaps, an unique phenomenon in the architecture of the Middle Ages, and, as such, may be considered as partly monuments of the genius of that extraordinary and unique Prince, Frederic II. of Hohenstaufen.

All these qualities, rarely found, I am inclined to believe, to such an extent in German monuments, seem united in the noblest way and with a superior degree of artistic skill in the north front of the Upper Castle at Marienburg.

It measures about 52 mètres length, and may be called majestic. Besides the tall corner towers, of Italian or Arab elegance, rising three stories above the battlements, with delicate tracery windows and arched friezes, the façade shows three unequal divisions in its length, corresponding to the chapel, the chapter-room, and the entrance. The latter, from its considerable height of above 14 mètres, reminds one somewhat of the imposing entrance-gates of Indian and Persian mosques. The large windows of the chapter-room, the still larger ones of the chapel, contrast beautifully with the broad surfaces of unbroken wall, the far smaller and rare windows of secondary rooms, and the regular openings of the crenelles (creneaux) of the battlement, decorated with shields. The monotony of the high brick-walls is cleverly avoided by a moderate use of glazed and coloured bricks, with dispositions reminding one in some places of oriental influence.

Herr Steinbrecht intends to close the exploration of these interesting buildings by a special monograph of this important residence, the restoration of which, if I am not mistaken, has been confided to him. By the way in which he has accomplished the task that was put into his hands, he has brought to our notice monuments of remarkable and, I dare say generally, unexpected qualities, well deserving the attention of those who, besides the mere architectural interest, are accustomed to read in the character of its monuments the reflection of the great deeds of history. He thus exhibits in a new light some of the characters of that once mighty Order, which, far weaker at its origin than the Templars and the Order of St. John, finally achieved results of a far more lasting and important nature, since, with the Margraves of Brandenburg, they are considered now as the founders of the Kingdom of Prussia.

H. VON GEYMÜLLER.

OLD MASTERS AT BURLINGTON HOUSE.

THE twenty-third loan exhibition of "Works by the old masters and by deceased masters of the British School," at Burlington House, is very unequal in interest, and betrays the difficulty which for the last few years has evidently been felt in keeping up these exhibitions to anything like their old level of interest, without repetitions. As we have before suggested, when the twenty-fifth exhibition has been held, and one generation may be said to have passed away, it is to be hoped that a new generation of owners will be asked and will consent to lend their greatest possessions in painting, already exhibited five and twenty years before, for the delight of a new generation of visitors who have had no experience of the glories of the earliest loan exhibitions of this series.

A good deal of the interest of the present exhibition resides in the landscapes, the comparison of which suggests besides some reflections as to the intellectual ends of landscape-painting, and the nature of the pleasure to be derived therefrom. Opposite to each other in the first room, for instance, hang a landscape of Müller's "Eel-bucks at Goring" (11), and one of F. Walker's, "Sunny Thames" (32). Are either of these two really like nature? And are they scenes on the same planet? We might allow an affirmative to the latter question, but certainly not to the former. Müller's picture (which at a first glance might be taken for a Constable) is a tremendous sketch of wonderful vigour, on the back of which we are told the painter has written "Left as a sketch for some fool to *finish* and ruin." Müller was right from his point of view; the picture is a most powerful piece of "impressionism," and the effect of it on the spectator arises in great measure from the sense it gives of the artist's power and freedom in recording his impression. As an actual representation of nature it is exaggerated in general effect and coarse in detail; it does not represent the scene, but the effect the scene produced on Müller's mind. Walker's painting is unlike nature in a totally opposite sense. Müller's scene is cold in tone and with a violent opposition of lights and shadows. Walker's is suffused by a warm quiet light in which the sky, the banks, and the stream are all harmonised. Walker never really saw bank and water and figures all in that suffused kind of pervading glow, but he saw them so in his sentiment, and the painting is the effect of the scene on his mind. So with Cotman's grand landscape (35), a poetic composition made up on the basis of an effect in nature. Bonington's "Coast Scene" (18) is far more like a real scene than any of these; it is managed nicely no doubt; the lights and shadows and half-tones are obsequiously in their places as regards the general composition; but still it is like an actual scene of the kind; it is real, not transcendental. Yet it must be admitted that it is a weak work in comparison with any of the three previously mentioned, and the pleasure it gives is weak also. There are more materials in the room for a "Philosophy of landscape-painting." Look at Richard Wilson's "Snowdon from Nantlle" (40), cut out of cardboard, as it were, and painted up like a theatre "flat." What a lesson on the debilitating effect of a constant course of "classical landscapes."

Both (48) and Hobbema (66, 67, 71) give their views of landscape also, the reduction of a landscape painting to a single recipe. Mr. Morrison's Paul Potter, "Carriage at a Roadside Inn" (89), is a nice little picture worth attention as a curiosity, being so unlike the typical Paul Potter, who is represented a few feet off by a very typical work, the "Young Bull" (94) from the Buckingham Palace collection. In the large room one of the places of honour is occupied by a landscape, Constable's "Opening of Waterloo Bridge" (137). As far as the foreground is concerned Constable, too, is here seen as an impressionist; he gives up the prosaic details of the sentinels and the caparisoned people in the barges, but raises the whole into a rich play of colour; and what a rich texture, too, in the architectural details of the foreground, and what a broad and airy light over the middle distance and the famous bridge. It is not like the real event probably, but it is worth a great deal more than any realistic transcript could have been. In the same room is a remarkably fine Turner, "The Lake of Geneva" (108), in his best period; his "Petworth House" (133) is one of the "pretty" Turner's, not to be despised in their way; his "Seapiece," (131) lent by Lord Leconfield, is another matter; "agitated sea" it is described in the catalogue, and so indeed it is—"agitated" in a way no sea ever was except in a picture of Turner's. One must not bow down blindly before even a great painter when he misrepresents nature in this way. As to the colour and texture of the waves, too, interrogations might be made; but we do not know how the present aspect of the canvas represents its original state.

Of the figure pictures the portraits are (as usual of late years) the strongest part, excepting the Earl of Dudley's Raphael, "The Crucifixion" (151) in Gallery IV. This is one of the pictures which makes one comprehend the feeling expressed by Ruskin and others as to the "Paganism" of Raphael. In this graceful composition we have the tragedy of the Crucifixion of Christ treated "in a decorative manner"; the Magdalene and St. Jerome kneel on each side in symmetrical pose, St. John and the Virgin stand behind in the same symmetrical manner, the cross in the centre; two small angels flutter in conventional attitudes beneath the arms of the cross, and their long fluttering ribands help to fill up otherwise empty space in the composition. In colour and grace of drawing the picture is a fine example of Raphael's work, but it is an extraordinary instance of the subordination of feeling and pathos to mere decorative effect. The painting by Lucas van Leyden opposite to it, "The Adoration of the Magi" (171) from the Buckingham Palace collection, is a fine and powerful work in its combination of gorgeously-clad figures with strange and abnormal piles of architecture in the background. Among the other works in Gallery IV., where as usual the older Italian paintings are collected, are to be noted Lucas Cranach's "Virgin and Child" (174) exquisite in the soft though formal beauty of the faces, which however have surely been freshened up to some extent; Da Vinci's "Virgin and Child" (165); and Sandro Botticelli's profile portrait of a girl in a red dress (144), a beautiful example of this type of art. Piero della Francesca's "Virgin and Child with Angels" (149) shows an interesting study of Renaissance architecture as a background.

Among the more modern pictures Reynolds's "Death of Dido" (105) occupies the centre position at the top of Gallery III.; a composition fine in colour and tragic in feeling, but undeniably theatrical. The curious decorative picture by Rubens and Snyder which hangs opposite to it, "Cupids, Fruit, and Flowers" (126), is a very fine work of its kind; the cupids by Rubens form an admirably painted group seated on the ground in the centre, Snyder's "swags" of fruit &c. hang across the upper part of the picture, and are painted with great force; the whole is a very fine piece of colour. Tintoretto is represented by two portraits of senators and by his "Apollo and Marsyas" (117), in which the figure of Apollo, with laurel branching round his head, and his right hand extended with the bow ready to commence playing his viol,* is a figure of remarkable beauty and a kind of godlike energy, which, indeed, seems to strike Marsyas, who is holding his own pipe away from his mouth, and anxiously awaiting Apollo's performance. Andrea del Sarto's "Virgin and Child" (121) is a charming example of that finish and balance of colour and composition which distinguished him who was called "the perfect painter." Mr. Beaumont's Giorgione, "The Adoration of the Shepherds" (112) is interesting more from the quaintness of the conception and the treatment of the landscape and buildings than from the qualities generally most characteristic of Giorgione.

Of the Dutch pictures, collected as usual in the second room, the finest is Teniers's "Man and Woman in a Cowhouse" (82), which is painted with great delicacy in every detail and is a fine specimen of Teniers in one of his "finishing" moods. The other Teniers near it, "Old Woman Consulting a Doctor" (87: lent, like the last-named, by Mr. Morrison), is admirable for the character of the two figures, especially in the scrutinising countenance of "The Doctor"; the picture is interesting also as illustrating an old superstition of the doctor's craft, mentioned in Shakspeare, but about which the catalogue is necessarily silent, and we must imitate its reticence. The picture by Maes, from the Buckingham Palace collection (85), is, like some others of the Dutch selection, a kind of second-best edition of what the painter has done better in other works; this part of the collection is not up to its usual level of interest. A Watteau in the same room, "L'Accordée du Village" (43) is curious for its resemblance

* Not "cithara," as stated in the catalogue. A cithara was played by snapping the strings with the fingers; "zither" is the modern form of the word. What Apollo is playing in the picture is the viol, an early form of the violin.

to the grouping and even the colour of Stothard (or Stothard's resemblance to it).

Among the portraits Gainsborough's "Mrs. Portman of Bryanston" (9) is a noble specimen of his powers: the lady is seated in an ample "white dress trimmed with lace," as the catalogue hath it, but in reality the very point of the matter is that there is no real white in it; Gainsborough knew better than that. The head is relieved against a crimson and flowered screen or curtain behind in half light; the "white" dress is just warmed sufficiently to harmonise and not clash with this; the whole has a grand unity about it. Raeburn's bust portrait of "Mrs. Smith of Jordanhill" (5) is a charming work; so also Romney's "Hon. Charlotte Clive" (36), in a pale yellow dress and reclined in a beautifully composed attitude. Romney's "Countess of Derby" (27), in a white dress and with a hand touching her chin, is still more delicate and graceful, though not so striking in colour as the former. Perhaps Romney's finest work here is "Mr. and Mrs. Lindow" (132), the husband seated and the wife standing by him, grouped so as to compose admirably without the slightest look of posing, and admirable also for the harmonious treatment of rather subdued colours in the two costumes; "a blue dress" Mrs. Lindow's is called in the catalogue, but it is something a great deal more subtle than that. Of a very different kind of power is Van Dyck's superb full-length of "The Earl of Portland" (123), one of the most remarkable impersonations of manly and aristocratic dignity ever realised even by Vandyck. A good Frank Hals is hung near this (124), and Rubens's remarkable portrait of the "Marchesa Isabella Grimaldi" (125) in her bridal dress; she married the Doge Doria, and her appearance and attire are worthy of so resplendent a match; the work is a superb example of what may be called the sumptuous or decorative order of family portrait.

The Water-colour Room and Black and White Room contain a fine series of water-colours, some of them well known (such as Cox's "Welsh Funeral"). There is a beautiful collection of William Hunt's works, especially fruit and flower subjects. A number of Turner's sketches and original drawings for vignettes and book illustrations are there, including the curious but certainly imaginative illustrations which he made for Egerton Brydges' edition of Milton; also a large number of sketches and studies by Cotman, which show him in the light of an architectural as well as a landscape artist. Turner's large and beautiful water-colour of "Fonthill" (19) is the culminating point of what is certainly not the least interesting section of the Old Masters Exhibition.

DAILY LIFE IN THE ANCIENT WORLD.

THE translator of Becker's "Gallus" says in his preface, "The idea of making an interesting story the basis of his exposition, and of thus 'strewing with flowers the path of dry antiquity,' is most judicious. We have here a flesh-and-blood picture of the Roman, as he lived and moved, thought and acted, worth more, a thousand times more, than the *disjecta membra*, the dry skeleton, to be found in such books as Adam's 'Roman Antiquities,' and others of the same nature, which, however erudite, are vastly uninviting." What Becker, with so much applause from his contemporaries, did for the daily life of ancient Greece and Rome, M. G. Maspéro, the distinguished Orientalist, and late Director of Archæology at Cairo, has essayed to do for the daily life of ancient Egypt and Assyria.* Whether the method of writing employed by the French, as well as by the German author, is the best which could be chosen for imparting knowledge, is a subject on which a word must be said later on, but if the method be accepted, much praise may be given to M. Maspéro for the able fulfilment of his task.

*"Life in Ancient Egypt and Assyria," from the French of G. Maspéro. London: Chapman & Hall. 1891.

We have here presented to us in one small volume the essence of a vast amount of widely-ranging investigation, including much original research, as well as comparison of the work of other labourers in the same field, and its publication ought to add considerably to popular acquaintance with two of the most remarkable nations of the ancient world. New and striking historical revelations are not, indeed, to be looked for here; the general aspect, both of Egyptian and of Assyrian society, is too well known for anyone to be able to astonish us by fresh accounts of their peculiarities, but any attempt to spread and render easier the acquisition of accurate knowledge of the ordinary conditions of life in former states of civilization is of great educational value. There are few phases of modern life, with which correspondences, often very instructive, may not be found in the pages before us, and without venturing into the deeper questions of religious and political organizations, a few matters of social interest may be noted, to give an idea of the variety of information which M. Maspéro has brought together.

Few subjects will have been so frequently in the minds of readers of this journal during the last few months as strikes of workmen, but neither the organisers nor the victims of our strikes need either flatter or bemoan themselves that they are better or worse off than were the citizens of Thebes three thousand years ago. We may read here,—

"Suddenly a great noise is heard at one end of the street, the crowd is violently opened, and about a hundred workmen, shouting, gesticulating, covered with clay and mortar, force their way through, dragging in the midst of them three or four frightened, piteous-looking scribes. These are the masons employed on the new buildings of the Temple of Mut, who have just gone on strike, and are now on their way to lay their grievances before Psarou, governor of the city, and general superintendent of the king's works. These small riots are not rare, they spring from misery and hunger. The greater portion of the wages consists of wheat, dhoura, oil, and rations of food, which the masters usually distribute on the first day of every month, and which ought to last until the first of the month following. The quantity allotted to each man would certainly suffice if it were economically used; but what is the use of preaching economy to people who reach home in a famished condition, after a day of hard work in which they have only eaten two cakes, seasoned with a little muddy water, about twelve o'clock? During the first days of the month, the family satisfy their hunger without sparing the provisions; towards the middle the portions diminish, and complaints begin; during the last week famine ensues, and the work suffers. If we consult the official registers of the scribes in the workyards, or simply the books of the overseers, we shall find notes in the end of each month of frequent idleness, and, at times, of strikes produced by the weakness and hunger of the workmen. Is their pay insufficient, or have they eaten their supplies unreasonably quickly? According to their own accounts, the scribes give them short measure, and enrich themselves by the robbery. On the other hand, the scribes accuse the poor fellows of improvidence, and assert that they squander their wages as soon as they receive them. No one could be astonished if both scribes and masons were found to be right."

It is often imagined that in ancient monarchies the occupations of soldier or priest were the only roads to riches and greatness, but in Egypt, at any rate, the "Civil Service" was highly esteemed, and its members often very prosperous; indeed, the attainments of an ordinary clerk might bring a man quite to the top of the social scale, as, after hearing of the education of a "scribe," we read:—

"His children will follow in the same path, and their children after them; there are whole dynasties of scribes, the members of one family having succeeded to the same posts for a century or more. Sometimes one of them, more intelligent or more ambitious than the others, makes an effort to rise above the usual mediocrity; his good writing, happy choice of words, activity, obligingness, and honesty,—perhaps, on the other hand, his prudent dishonesty,—attract the attention of his superiors and secure his advancement. Cases have been seen of the son of a peasant or of a poor citizen, commencing by booking the delivery of bread or vegetables in some provincial office, and ending, after a long and industrious career, by governing one-half of Egypt. The rooms of his barns overflow with corn; his storehouses are full of gold, valuable stuffs, and precious vases; his stable 'multiplies the backs' of his oxen, and the son of his first protector dare only approach him with his face bent to the ground, dragging himself upon his knees."

A curious parallel between the customs of modern London and ancient Thebes may be traced in the illustrations representing the royal chariot-horses, which have their heads as cruelly tied-in by tight bearing-reins as any unlucky horse to be seen now in a fashionable carriage; another, from which divers morals may be drawn, is shown by the statements that "beer-shops drove an excellent trade," and "beer has always been the favourite beverage of the people," in spite of "the moralists who cannot find words strong enough to express the danger of it."

Building, except in the case of temples, is described as being in Egypt a very simple and inexpensive operation. After an account of a disastrous hurricane, which has utterly wrecked every house in the district, we are told that:—

"Elsewhere such a catastrophe would entail utter ruin; here one or two weeks of labour suffice to repair it all. As soon as the rain has ceased, the whole population,—men, women, and children,—exert themselves, and hasten to draw from the rubbish the wood, provisions, and utensils that have resisted the inundation, then from the diluted mud of the old buildings they make new huts, which the sun quickly dries and cracks in all directions. Two days later no traces of the accident remain. A little more time and labour are required to rebuild the houses of the better classes. Two or three labourers go down to the nearest pool, and collect pailfuls of mud from the bottom, heap it upon the bank, knead it, mix it with gravel and finely-chopped straw, and press it into wooden moulds, which an assistant carries away and empties out into the sunshine. In a few hours the bricks are ready for use, and the building is commenced. No one thinks of clearing the ground or of digging foundations; the people are satisfied with levelling the rubbish, and placing the first bricks loosely upon the kind of bed they have thus prepared. A fortnight later the ground-floor is closed and roofed in, the family re-enter the dwelling with their cattle, and live in it whilst the upper story is being completed."

Turning to Assyria, we get some glimpses, in the second portion of the book, of the architecture of that country, from which it appears that private houses, just as in Egypt, were not built in a manner calculated for long endurance, and were also studiously devoid of any outward show. The art of building was evidently thought much of by the ruling orders of the Assyrians, for we read that "the bricks destined for public buildings are holy, and can be made only at certain seasons. They are prepared under the auspices of a particular god, Sivan, lord of foundations, and only during the month to which he gave his name;" and also that before beginning a new palace, the king, after sacrifices, and with great solemnity, prayed that "Sivan and his father, Bel, the architect of the universe, would consent to direct the works." But their architecture was almost entirely confined to palace-building, for their temples, unlike the great independent establishments of the Egyptian priesthood, were only what might be called chapels-royal, included in the general group of palace-buildings, and occupying a comparatively small corner of the inclosure; of which, however, they were often very conspicuous features, being built of tower-like form, and decorated with lavish wealth of ornament.

The Assyrian, or as it might more properly be called, the Chaldean, method of land transfer, is well known as having been brought to a system of elaborate completeness, and a specimen is given of a deed of conveyance of an arable field, though some other extant documents, relating to the purchase of town-property, are still more interesting, and show that surveying must have been an important profession amongst the inhabitants of the father-land of geometrical science. The plan adopted in these transfers for recording the particulars of sale and for guarding against subsequent attempts at fraud was extremely ingenious. The documents were inscribed on clay tablets, which, when sealed both with the seals of the contracting parties and the judge before whom all such transactions had to be performed, were placed in an oven and converted into

almost indestructible bricks. But to prevent any tampering with them, besides taking the precaution of making three copies, the third of which was deposited with a royal notary, "the tablet, once sealed, was covered with a second layer of clay, upon which they traced an exact copy of the original deed. The latter thus became inaccessible to forgers, and if a dispute arose, and some alteration was suspected in the visible test, the enclosing tablet was broken before witnesses, and the deed was verified by the original writing preserved inside."

The translator's work (by Miss Norton) is very well done, and is not disfigured by those too literal interpretations of French phrases which make many translations look so awkward; but a few curious words, some of them probably only printer's errors, should be noted for correction, *e.g.*, "which *respond* to our cardinal points," "have faith in formulas and *talismen*;" "the head of a *cynophelus*;" "the Phœnician merchant-ships have at many points *stable* establishments;" "rising with bowed *spine* and drooping arms;" ("spine" is frequently used for "back") and "the experience acquired in navigation upon *soft* water, enables them to dispense with a long apprenticeship upon the sea," a most original use of the word "soft" as applied to water. The illustrations, though rather roughly executed, are all to the point, and greatly add to the interest of the book, which will probably achieve some success, although there already exist many others on the same subjects which might be thought better suited for English readers. It belongs to a peculiar, nondescript class of writings hitherto more popular in France than in this country, a good deal resembling the "architectural novelette" of Viollet-le-Duc, and, like that, being neither plain history nor an antiquarian treatise, nor yet a real story, but attempting to combine all three, having enough air of fiction to spoil the reality of the historical portion, and enough antiquarian detail to make it unreadable as a tale, and unconnected as a chronicle. The student of history or antiquities would probably prefer to enjoy his facts without the uncomfortable feeling of unreality which the method of presenting them gives him at every turn, while the ordinary reader, who cannot endure a book unless it contains a story, could not possibly be beguiled by such a thin film of narrative into wading through what is practically a dictionary of antiquities, heavy with the minutest erudition. We believe that the enthusiastic student will still prefer to go straight to the works of Wilkinson and Layard, which in popular editions are now easily accessible; while the more numerous class of readers who for a picture of Roman life would turn rather to the pages of "The Last Days of Pompeii," than to those of "Gallus," will still find their best realisation of the ancient world in such books as Ebers' "Uarda," or Whyte-Melville's still more romantic "Sarchedon."

NOTES.

WE regret to hear of the death of the venerable M. Bailly, Member of the Institut de France and President of the "Société des Artistes Français," and long an honoured name among contemporary French architects. He was eighty-two at the time of his death, and in spite of his great age, and of the illness which finally carried him off, and which two months ago prevented his attendance at the annual meeting of the Académie des Beaux-Arts, he pursued his studies almost to his last hour. Antoine Nicolas Bailly was born at Paris in 1810 and was a pupil of Debret and of Duban, and in 1834 was attached to the municipal administration as an Inspecteur. Ten years later he was appointed "Architecte du Gouvernement," and then diocesan architect at Bourges, Valence, and Dignes, and restored the churches in these ancient towns with great ability and erudition. He was subsequently appointed "Architecte-en-chef des travaux d'entretien" to the Paris municipality. At the close of the Empire he retired from this post with the title of "Inspecteur-Général Honoraire." Independently of the work which he carried out at the Hôtel de Ville under Godde and Lesueur, he also carried out the Mairie of the Fourth arrondissement, and the Lycée St. Louis at Paris, the Tribunal de Commerce, the restoration of the house of Jacques Cœur at Bourges, &c. He was a Commander of the Legion of Honour and received medals at various exhibitions. He replaced Labrouste as member of the Académie des Beaux-Arts. He took an active part in the foundation of the "Société des Artistes Françaises," where his zeal, impartiality, and amiability of character secured him general regard, and his loss is regretted by a large circle of friends.

IF ever a peerage is the fit reward for scientific eminence, never was that distinction better bestowed than on Sir William Thomson. The days are past when a man could say with Bacon, "I have taken all knowledge to be my province"; nor is it now possible even to so take all science, but Sir Wm. Thomson may justly claim to have taken all *physical* science as his province, and there are few who can rival him in any one branch of it. Go where you will, we find traces of his restless activity. Every telegraph office is stocked with instruments of his invention; a large part of London is lighted by dynamo machines which are modifications of one of his; and in the test-rooms of all the installations in the world the most accurate instruments are his also. We go to sea, and we find the means of taking soundings without stopping the ship, designed by Sir William Thomson; we arrive in port and find the height and time of the tides predicted by Sir William Thomson's tidal clock. Perhaps we are interested in questions of speculative science,—the age of the earth,—the constitution of matter, and the size of its ultimate molecules,—the origin of life on the earth and its probable duration,—none of these questions can be adequately discussed without mention of his name, and on some of them he is the only authority. In collaboration with Professor Tait he has written what is generally accepted as *the* text-book on Natural Philosophy, and some of the most brilliant mathematical investigations we have ever seen are due to him. When the history of science in the nineteenth century comes to be written, three names will stand out pre-eminent, those of Faraday, Darwin, and Sir William Thomson.

THE new volume of the *Transactions* of the Institute of Architects forms certainly one of the best practical answers which could be supplied to the charge brought against that body recently of being indifferent to the artistic side of architecture. With the exception of the paper, "A tour in the United States," by Mr. Cox (who, as holder of the Godwin Bousary, was under a special undertaking to direct his attention to practical construction), the whole volume, with its copious and in many cases beautiful illustrations, deals entirely with architecture in its artistic aspect. The volume includes Mr. Phené Spiers's copiously illustrated paper on "Sassanian Architecture"; Baron de Geymüller's essay on "The School of Bramante," one of the most valuable recent contributions to the study of the architecture of the Renaissance; Mr. Starkie Gardner's paper on "Wrought Ironwork" of the Mediæval period; Mr. Simonds's paper on "Some Aspects of Sculpture considered in relation to Architecture"; Mr. W. Simpson's paper on "Origin and Mutation in Indian and Eastern Architecture"; and papers by Mr. Brydon, Mr. W. B. Richmond, and Mr. Westlake, on "Decorative Painting." Mr. Somers Clarke's paper on the "Fall of a central Pillar at Seville Cathedral" may be said to partake both of archæological and structural interest, and is of value as coming from an architect who had special opportunities of studying the results of the catastrophe on the spot. Some of the authors are not members of the Institute, but that they should be invited to read papers on branches of art with which they were specially acquainted certainly does not argue indifference to the art of architecture on the part of those who invited them. The whole volume is one of the best and most interesting which the Institute has put forth, and the illustrations alone should give it a high value to all students of architecture.

IN the *Times* of the 6 h Mr. Holman Hunt writes to call attention to a matter which may well make the whole artistic world feel a shiver of apprehension. Visiting the Campo Santo at Pisa the other day, Mr. Hunt saw an erection evidently raised for some painter's convenience, and on inquiry found it was not for the harmless exercise of copying the frescoes, but for an artist engaged in *repainting* the figures! Mr. Hunt adds—

"I was able to see that this meant the blackening of the celestial purity of colour, and the muddling of every delicate form in the innocent drawing of the figures. It is not disrespectful to the painter to say this, for surely no living master could trust his hand to improve a surface on which time, where he has been able to weaken, has had no power to unspiritualise the traits.

It is true that the work remaining has to risk peril of effacement, but this danger would surely be more wisely met, and it has been in other cases in this country, by covering the surfaces with sheets of glass, or even by glazing all the open spaces in the cloister. Should it be urged that the original strength of colour should be renewed, surely this might best be done on copies carried first to the existing pitch of strength and then enforced at discretion."

If there were no alternative, it would be better to take copies for preservation and let the originals die out, as in the long run they must. What is their value, artistically or historically, when "repainted"? It is one of the saddest and most hopeless pieces of news of the kind that we have heard of for some time back. Mr. Holman Hunt's letter, we may add, merits all the more attention because it is written calmly and judicially, and without that hysterical kind of exaggeration in which those who deplore restoration are too often wont to indulge, and which tends to defeat its own end.

THE various trading associations in Ireland are bestirring themselves, and have put in an appearance at the Board of Trade in opposition to the proposed rates for Irish lines. With a view of coming to some agreement whereby a protracted inquiry would be avoided, conferences have been arranged between the parties interested. At the first of these meetings, which was held last week, and which was well attended by representatives of the railway companies and the trading community, Mr. Courtnay Boyle presided; and on his recommendation an adjournment was made in order that figures might be obtained in support of the statements made as to the effect of the proposed changes. This, each party will doubtless be able to do to their own satisfaction; while the Board of Trade will probably, as before, steer between the two. Some of the English traders are still hoping to obtain amendments to the classification,—notably the timber merchants, who desire to have the term "timber" defined as embracing all rough and unmanufactured wood, whether round or squared. All are awaiting with some anxiety the appearance of the revised rates, and many supposed that alterations would be made on the 1st inst. As far as we can learn, however, the old rates generally remain in force; and, as has been previously intimated, it is very improbable that any important changes will be introduced until much later on in the year.

FOR the first time for many years the Railway Clearing House are not issuing a fresh edition of their Classification with the new year. It has always been the rule for a revised list to be published on January 1, incorporating the various additions and alterations which the previous year's experience has shown to be necessary; but on this occasion

the revision is deferred pending the completion of the new rate-books, upon which the railway companies are still busily engaged. It is probable that a fresh edition will be published later in the year, remodelled on the lines of the Parliamentary classification settled last session, and possibly some of the provisions of the Act will be set forth.

THE agreement arrived at between the Great Northern Railway Company and the Manchester, Sheffield, and Lincolnshire Railway, by which the former company on certain terms has withdrawn its opposition to the extension to London of the latter, is likely materially to improve the chance of the passing of the Bill which was thrown out last Session. That the Bill will be modified in some form is pretty certain, but it is difficult to believe that the opposition of the inhabitants of St. John's Wood can prevent the passing of the Bill. That a new trunk line can be financially successful is, however, very improbable, but if the localities through which it passes desired, and there is no strong opposition, Parliament will hardly concern itself with the possibility that the shareholders may lose their money.

IN a "Note" on June 27 last we adverted to the Government scheme for an enlargement of the Record Office. Three weeks ago the materials of Nos. 6 to 20, on the eastern side of Chancery-lane, were sold at auction, and the fifteen houses are now being pulled down. The demolition includes the stone gateway, having a side footpath, which leads into Rolls-yard, and situated directly opposite to the chapel's western end. The old houses we speak of have for some years past been filled with Record Office stores, papers, &c., but being very unsuitable for that purpose will, as we understand, be replaced with a more commodious and fireproof structure.

BY their recent vote of 3,476*l.*, as half of the purchase-money, the London County Council secure the addition of 3½ acres, finely wooded, of the Bedford-hill estate, to Tooting Bec-common. This, and the adjoining Tooting-common,—being 207 acres in all,—their predecessors rescued from further encroachment and spoliation in 1875. The manors of Totinges, Estreham (Streatham), and Belgeham (Balham) are cited in Domesday survey; the former two as held of the Abbot of St. Mary de Bec. By an escheat of 8 Edward II., it appears that the priory of Okebourn, Wiltshire, an alien cell of Bec, held the two manors, by service of a knight's fee, of Gilbert de Clare, Earl of Gloucester, who fell at Bannockburn. At the seizure of alien priories, 2 Hen. V., the consolidated manor became vested in the Crown. In 1441 Henry VI. assigned it as part endowment to Eton College; but his successor, who resumed some of the grants to Eton, gave it to Lawrence, Bishop of Durham, for life. According to Rymer's "Fœdera," the priory or manor of Totyngbeke, as parcel of Okebourn, reverted, with the advowson of Streatham, to the King, who settled them upon John Tiptoft, Earl of Worcester, master, and the wardens of St. Mary's Guild, in All Hallows, Barking, Church. In 1599 it was bought by Sir Giles Howland, Knight, who is supposed to have built the manor-house at corner of Streatham-common, on the Croydon-road.* Elizabeth, heiress of John Howland brought the property in marriage to Wriothesley, second Duke of Bedford, who in 1695 was created Baron Howland, of Streatham. Their descendant Francis, fifth Duke, conveyed the house and grounds to Lord William Russell, and in June, 1816, John, sixth Duke, sold the manor, according to Brayley's "Surrey." Streatham Place, close to Tooting Bec-common, the home of the Thrales, has been quite dismantled. The house and its contents were sold in 1816; amongst the portraits being those, by Sir Joshua Reynolds, of Sir Robert Chambers (80 guineas), Goldsmith (127 guineas), Dr. Burney (80 guineas), Sir Joshua (122 guineas), Burke (240 guineas), and Dr. Johnson (360 guineas). A woodcut of the house is in the *Monthly Magazine* of July, 1823.

* The home of Lord William Russell, who was murdered by his valet Courvoissier (1840), and rebuilt by Lord Deerhurst, seventh Earl of Coventry.

THE usual correspondence in the papers about fogs and the wickedness of scientific men who do not stop fogs, has followed the recent fogs in London. We have the same thing every year, and indignant people write letters to the *Times* speaking as if the authorities of London had only to give the requisite orders to shut off fog at once, and that it is only through pure "cussedness" that they do not do so. One correspondent, "Lucifer," who unfortunately does not give his name, but who says that he is a chemist, seems to be possessed with a somewhat more reasonable spirit. He observes—

"What we need for the formation of an ordinary mist is a chilled vapour-charged atmosphere and minute, solid particles to serve as nuclei for the condensation of this vapour into the droplets of water of which mist is composed. This mist may be aggravated into a fog if from any cause it is made abnormally dense, and it happens that such conditions exist in towns. . . In towns these conditions are the existence in the air of an abnormally large supply of solid nuclei—which are quite independent of smoke—and the prevalence of sulphurous acid, which, likewise, is independent of smoke. This sulphurous acid comes from coal and, as you justly remark, will come from coal whenever and however that coal is burnt. The amount of this gas sent into the air of London in one day is prodigious, for it will weigh about one-fiftieth of the total coal consumed. That the intensity and pungency of town fogs are due to this is a view which has been confirmed by so high an authority as Helmholtz (the Sir William Thomson of Germany), and it is idle to talk of the reduction of fog to mist by the smokeless burning of coal. It is no doubt true that the dirtiness, flavour, and unpleasantness of fog are much increased by the admixture of smoke, and no effort should be spared, in fair weather or foul, to mitigate the smoke nuisance. It acts, too, as an intensifier of fog, as has been shown by Dr. Frankland, by retarding the evaporation of the droplets of water of which the fog is composed.

Scientific men are continually being called upon to invent some means of dissipating or preventing fog. Professor Oliver Lodge has shown that fogs may be dispersed by means of a continuous discharge of electricity into them; but he would, I feel sure, be the last person to anticipate that such a method could be applied outside Utopia to the smallest town in the kingdom."

We commend these remarks to the attention of those enthusiastic persons who are constantly urging that we can prevent London fog at will. "Lucifer" goes on to observe, truly, that the general adoption of gas for heating and electricity for lighting would be "a solution of the fog question"; but in saying that he himself goes too far. It would remove the excessive darkness and irritating character of the fogs; but would still leave them as white fogs. The recent fog of London extended over a considerable tract of country, only it had not the same character in the country as in London. And it would remain to be considered whether this change from a smoky brown fog to a white one would be a sufficient good to compensate for the permanent exchange of gas fires for the warm and cheerful coal fire. Some people would probably think otherwise; but of course the majority have the right to decide the point, and if coal fires are condemned the minority must give way. But we rather doubt it really coming to that. People may think so while a fog lasts, but when it is gone they will sigh over the loss of their comfortable fire.

THE fog correspondence has produced complaints also, as usual, from passengers by the railways. Some of these are perfectly reasonable, and some of the delays might have been prevented. At Euston it is extraordinary that the Board of the North-Western Railway have not introduced a more efficient system of lighting. In foggy weather the delays on that line are chiefly produced by the difficulty experienced in sending trains from the terminus. Strong lights will not altogether prevent difficulties from severe fogs, but they will do a good deal to alleviate the trouble.

SOME NOTES ON THE HISTORY OF ENAMELLING.

BY J. STARKIE GARDNER.

THE art of enamelling is very ancient, and consists of fusing a coating of glass upon metal. Metal, however, being tough and malleable, and in many other respects the opposite of glass, and the two bodies having different measures of expansion and contraction, skill and experience are needed to unite them. When the metal to be enamelled is thick its surface is divided into cells, in order that its expansion and contraction may not shiver the glassy skin; but when the metal is thin, it is usually coated all over by the enamel, which acts as an envelope and protects it uninjured by ordinary changes of temperature. This difficulty has probably gone far to determine the various forms of enamel known to art, and which may be grouped into cellular and glaze enamels. The cellular group is divided into those in which the metal surface is gouged out, called *champ-levé*, and those in which cell walls are added to its surface,—*cloisonné*. Fusion in these was, and is usually, accomplished under the blow-pipe, while glazed enamels were fused in the muffle or closed oven.

The enamel is simply a more or less fusible glass which is transparent unless mixed with tin, when it becomes opaque. The colours used are of course only such as will stand heat, and practically are oxides of different metals,—copper, cobalt, iron, gold, manganese, &c. The range of colour is almost unlimited.

There is some difference of opinion as to whether the Egyptians ever fused the enamel paste they produced on to metal, or whether they merely used it as an inlay. There is none as to its very sparing use by the Greeks in jewellery. It seems to have been unknown to the Etruscans, Romans, or any other civilised nation previous to the Christian era.

It was, however, known to one barbarian nation, our own, in prehistoric times. It can never be known exactly, but as all British enamels are stanniferous, the discovery must have been due to some smelting of tin and bronze. Until the Roman colonisation, enamelling seems to have been confined to small trappings for man and horse, but later highly decorated vases and bowls were made and exported. The ivy was much used in their decoration, and the classic laurel-leaf border is often introduced. The Gallo-Romans seem to have practised the art to some limited extent, and the Italians appear to have produced a bastard enamel by inlaying the *millefiori* and other glasses in jewellery, and fusing them sufficiently to unite to the metal.

It is unlikely that this art was connected with enamelling as practised at Byzantium, many centuries later. On the other hand, there is sufficient evidence that it was never lost in the British Isles. A kind of *champ-levé* process had been handed down from time immemorial, the metal being cast, and the cells filled with yellow, red, green, white, and blue. Several vases of British manufacture have been found in France, Germany, and Denmark. In Ireland also, the art of enamelling was known in very remote times. The exquisitely beaten shields and helmet found in the Thames, and now in the British Museum, and the horns of the same workmanship in Dublin, are alike decorated with small blood-red enamels, and many of the Celtic brooches are set with enamels. The Ardagh chalice, which dates probably from the eighth century, is of peculiar interest, as being perhaps the earliest enamel in existence made for a sacred purpose, and as having served as a type on which others were fashioned. It is decorated with three kinds of enamel, all of them showing a marvellous amount of thought and skilful manipulation. The Irish enamels present indeed processes such as the inlay of one coloured enamel in another, and the pressing of the metal filigree into hot enamel, which are quite peculiar, and should enable us to recognise them wherever met with. While tin appears to have been a necessary ingredient in British enamels, it is not present in some of the oldest from Ireland, which are translucent; and the coarse British variety of

champ-levé is abandoned for the more delicate *cloisonné*.

The next step in our history was a very important one, the introduction of pictorial representations in enamel, and this step also was taken in England. In the well-known Alfred jewel found in Athelney, and inscribed with the words, "Aelfred mec heht gevurtan," we have a most beautiful example of cloisonné on gold, bearing a portrait, and rich in translucent enamel of fine hue. No piece of cloisonné enamel, bearing such strong intrinsic evidence of its date, is to be met with which can compare with it in antiquity.

But it does not stand alone. An exquisitely worked brooch found on Dowgate-hill bears a delicate cloisonné portrait of a royal person, supposed to represent Alfred or his father. Like the Alfred jewel, it is rich in translucent green and blue, the flesh tints being opaque, with a golden-yellow crown, and with pearls and black enamel rosettes set in its filigree gold border. An equally beautiful brooch of the same workmanship reposes beside it in the British Museum, in the centre of which is a highly decorative cross in deep translucent blue and ruby. These superb specimens of cloisonné jewellery are linked to the older British enamels by a curious unfinished plâque, also in the British Museum, and found in London, enamelled in blue, red, yellow, and white, which has a somewhat Mediæval feeling; and still more so by the ring of King Æthelwulf, of blue and green champ-levé on gold, inscribed with his name and two eagles, or perhaps ravens. A ring of not dissimilar style, but filled with niello in place of enamel, is inscribed with the name Ahlstan, supposed to be the Bishop of Sherbon, 823-67.

These enamels have not hitherto been universally admitted to be of English manufacture, but the inscriptions on them, and their refined style and execution, are strong arguments in favour of their native production at the time when England occupied the leading position in the arts and sciences. We may admit, if necessary, that the introduction of portraiture may have been due to the journeys that Alfred and his father made to Rome. Those who find it difficult to admit an English origin for these enamels, regard them as of Byzantine origin, but there is no clear evidence of the production of enamels in Byzantium prior to the tenth century, and none exist which can be attributed with certainty to a date earlier than about its close. The pectoral crosses, of which there are two in the Kensington Museum, appear to be the oldest. The designs are fashioned in delicate gold filigree, and in colour and technique they are not dissimilar to our portrait enamels. The beautiful series of plâques discovered in a field, and now in the National Hungarian Museum, are typical Byzantine work, and their date is known to be between 1042 and 1054. They probably formed a crown like that of Charlemagne in form. The most famous Byzantine enamel in the world is the Pala D'Oro, the golden altar-piece of St. Mark's Cathedral, Venice. None of the enamels which enrich it are, in the opinion of Mr. Franks, older than the figures of the Empress Irene and the Doge Faliero, about 1105, while others are as recent as 1209. The equally remarkable golden altar at Milan, known as the Paliotto, is not believed to be Byzantine, and being executed by one Wolvinus, an unmistakably Saxon name, at a time, 835, when it cannot be shown conclusively that enamelling was practised except in England, there is some slight (*a priori*) ground for hoping that it may prove to be an English work. Small enamels, set as jewels, abound in works as old as this, such as in the crown of Monza, about 625; the reliquary of Sion, 720; that of Pepin, in the crown, sword, and gloves of Charlemagne; the A of Charlemagne and many other objects preserved in the Treasury of the Abbey of Conques, &c. Some of these may be English and Irish, and their origin may be as various as those of the gems which accompany them. The strongest evidence in favour of the antiquity of the art of enamelling in Byzantium is the fact that we find the art transported to Germany soon after the marriage of Otho with Princess Theophaine in 973. The enamels at Essen, inscribed with the names of Matilda, Abbess 974-1013, and Theophanie, Abbess 1014-1054, are generally regarded as the oldest of German origin. The former are of the finest work, being perhaps executed by Byzantine workmen. The Germans soon resorted to the champ-levé process on copper, very frequently combining it with gold cloisonné for the more delicate details. A few Byzantine enamels are known of this mixed kind, but in these the copper is beaten up to form the design, instead of being chased out as in the champlevé. The seat of the manufacture seems to have been at Cologne, and nearly all the large shrines and reliquaries preserved in Germany are of Rhenish production, and nearly thirty of them still exist in the diocese of Cologne. Among the most important is the shrine of the Magi at Cologne, of the Virgin at Aachen, Saint Servais at Mästricht. German enamels are characterised by somewhat rude drawing and the use of many colours, which are generally shaded and sometimes blended. As we have seen, cloisonné decoration was frequently, almost habitually, used for small details on the base of champlevé work. We possess in the Soltikoff reliquary at Kensington one of the finest specimens of early German enamel in existence.

In addition to the Rhenish production we have evidence of an important seat of the industry on the banks of the Meuse, in Lorraine, in the twelfth century, Abbot Suger having taken his workmen from thence to St. Denis in the years 1143-47. The splendid altar front of Klosterneubourg, consisting of fifty-one plates of champlevé enamel, was made by Nicolas of Verdun, 1181. Enamelling was also carried on at Maestricht in the thirteenth century, but the style of Limoges was followed.

The German and other enamels, about which little is really yet known, deserve most careful study, as many enamels are referred to a German origin, which in refinement of design, delicacy of detail, and general style, in no way resemble the ordinary expressions of German art. Still less do they resemble Byzantine or Limoges work. It is significant that most of these have been found in England, whilst much evidence can be brought forward to show that enamelling was an important art in England during the twelfth to the fourteenth centuries, when English enamels were prized on the Continent. Instances of this are the enamelled clasp in the Inventory of the Duke of Normandy, 1363, the enamelled gold goblet and ewer given by Henry IV. to Charles VI., the fine specimen taken as a souvenir of his visit to this country by Charles V., &c. We possess, moreover, a few acknowledged enamels of English production, such as the Lynn cup and Wykeham crozier, which are of fine workmanship; and, if we wish farther to gauge what English enamellers were likely to produce, we have only to look at the thirteenth-century glass remaining at Canterbury or York, to feel convinced that it would be of high quality both in refinement of drawing and beauty of colour. It is interesting to notice that Richardin, an enameller from London, was one of the first of the craft established in Paris, 1292.

Among the most beautiful examples are those in which the surface is divided into small panels in the fashion of the contemporary stained glass. The dividing lines are generally ribbons bearing leonine verses remarkable for their erudition and thought. The compartments are round, lozenge shaped, or polygonal, and contain exquisitely-drawn groups of figures, either biblical or allegorical subjects. To this unfortunately rare group belong the Meyrick crozier, the Warwick bowl, the Bruce bowl, the Savernake horn, and the chalice of Wilten in Tyrol, and, perhaps, a curious enamelled flask in the Berlin Museum. That this panelled or diapered treatment was always a favourite one in England there is abundant evidence to show. We find it in all sorts of examples, such as the beautiful Fair Rosamond ring, the painted roof of Peterborough Cathedral, and many of the early cups belonging to colleges and corporations.

The triptych from Alton Towers, as pointed out by Mr. Franks, is not dissimilar in its style, being divided into nine compartments, with scriptural subjects and leonine verses. Another triptych, also in the Kensington Museum, which might be claimed as English, was found in Essex, formed part of the Arundel collection, and figured in the "Archæologia." It is remarkable for the fine drawing of the subjects in the eight compartments, and for its translucent enamels. A very similar specimen is in the Kensington Museum. The beautiful Lynn cup of the time of Richard II. is also divided into compartments, on which are small and delicately drawn figures on translucent enamel. Part of a very beautiful cup, 1276-1316, at All Souls' College, and the binding of the Bodleian Psalter, are also enamelled in brilliant translucent colours, and are undoubtedly English. The English origin of the Wykeham and the Limerick croziers and mitres, the latter inscribed by Thomas O'Carty, 1418, has never been questioned, and both are superb examples, not only of the goldsmith's, but of the enameller's art. When we remember that the goldsmith's and other artistic work produced at Ely, Glastonbury, Durham, York, Colchester, St. Albans, &c., was celebrated from the eleventh to the thirteenth centuries, and that vast treasuries of this work were frequently accumulated, it would, indeed, be matter for surprise if our country were as destitute of examples of its ancient art as is generally supposed.

When we can place the English origin of a few more enamels beyond doubt, the study of the rest will be greatly facilitated. They seem to have been much more varied than those of other countries, and hence require particular care in distinguishing them. Armorial bearings are enamelled on the shields to the tombs of Edward III. and Richard II., and on the shields and belt of the effigy of the Black Prince, while a sword of Edward III. has a handle enamelled with his arms. A few caskets, like that of De Valence in the Kensington Museum, a small shrine with St. George and the Dragon, with a few other objects, and the armorial bearings on the herse and tomb in the Beauchamp Chapel, belong to the same group. Of great interest, too, are the Garter plates at Windsor, beginning in 1368, and extending over a period of 500 years. The inventories of the jewels belonging to Edward II. and III. mention 200 distinct enamelled vessels.

The name of Limoges is first connected in a definite way with enamelling towards the third quarter of the twelfth century. The celebrated enamelled brass of Geoffrey Plantagenet, father of Henry II., is still preserved at Le Mans, and is especially interesting from its heraldry. This Prince died in 1151. The enamel, however, is very unlike any work of Limoges, and the proofs of its origin advanced are quite inconclusive. Among the earliest undoubtedly authentic works of Limoges are the two plaques from the Abbey of Grandmont in the Cluny Museum. One bears an inscription claimed to be in Limousin pâtois, and the date assigned them is prior to 1188. A still more characteristic specimen is the fine chasse of Mœzac. Authentic twelfth century specimens of Limoges work are, however, extremely rare, the vast mass of Limoges enamels belonging to the thirteenth century. At this time they enjoyed an extraordinary popularity, and were exported far and near. One of the best known, and a signed work, is the pyx of Alpaïs in the Louvre. We possess an almost corresponding piece in the British Museum. The most important objects are the reliquaries in form of ecclesiastical edifices with high pitched roofs. Other objects are croziers, crosses, missal covers, pyxes, &c. These are nearly always decorated with figures representing the Adoration of the Magi, the Flight into Egypt, the Martyrdom of St. Catherine, St. Valerie, St. Thomas à Becket, &c. The figures on the reliquaries are stiff and without much movement, often badly drawn, and are either outlined on a gold ground on an enamelled field or enamelled on a gold field. The heads, or sometimes the whole figures, are often embossed in high relief. Gems and filigree are rarely used to enrich the effect. The tone of colour used is decidedly blue, and the effect brilliant. The ground is almost universally a deep ultramarine; but a darker blue, as well as turquoise and sky blue, are also used. Red, purple, light and dark green, white, yellow, and black are used sparingly. Ultramarine draperies are bordered with light blue or white, and green is bordered with yellow. There is great sameness about the work, which is often exceedingly coarse, as if the objects had been produced in quantities for export. Very highly finished Limoges work is rare, and the pedigree of several unusual examples claimed by French writers requires careful examination. It was, no doubt, partly owing to its inferior and monotonous execution that it fell into complete disfavour in the fifteenth century.

French writers claim that all the enamelled tombs and effigies, formerly abundant, but now excessively rare, were produced at Limoges, which held a monopoly of such work. A list of them is given in Ernest Rupin's "L'Œuvre de

Limoges." Many are only known from de Gaignière's drawings, and notes preserved in the Bodleian. The tombs of Blanche and Jean, children of St Louis, who died in 1243 and 1248, are now in the Abbey of St. Denis, and the effigy of Blanche of Champagne, 1283, is in the Louvre. Other tombs, presumably of Limoges work, are preserved in Spain. That of William de Valence, made in 1296, is still in an extremely perfect condition as regards the effigy. It shows a pillow, belt, and shield, emblazoned all over in the richest way with the arms of Valence. The enamel is on plate copper, fixed to a rough wooden core. There is no record as to where it was made, and there is no other tomb resembling it in England; but an enamelled tomb was ordered from Limoges in 1277 for Walter de Merton, Bishop of Rochester.

Enamelling was carried on in other parts of France, particularly in Paris, but hardly any pieces can be identified, and the study of Mediæval enamels, notwithstanding the books that have been written, is still in a very imperfect state. J. S. G.

Illustrations.

SELECTED DESIGN FOR THE MUNICIPAL BUILDINGS, BATH.

WE have already in a review of the Bath Municipal Buildings Competition (page 478 of our last volume) given a description of the main points of this design, by Mr. J. M. Brydon, which has been awarded the first premium and, we understand, accepted for execution. We give the principal elevation and the plans of the two principal floors.

We have nothing to add to the remarks we have already made on the plan and design; but the following summary, communicated to us by the architect, may be given as setting forth his view of the objects and treatment of the building:—

"In describing the general arrangements of the proposed new buildings, it will be noticed that the accommodation provided divides itself into two main sections.

1. The administration of justice, comprising the new Sessions Court and the rooms connected therewith. These are located on the ground floor.

2. The public service, comprising the new Council-chamber and the offices of the various departments for the business of the municipality. These are principally located on the first floor.

In working out the details of these two sections, the additions have been so arranged with reference to the present Guildhall that, though each is distinct in itself, together they form a complete scheme, in the consideration of which the old and new buildings may be taken as a whole. With this view the present entrance in High-street is allotted to the courts and the banquetting-hall, and a new entrance is provided at the Orange-grove corner for the Municipal offices. Spacious and amply-lighted corridors connect these two approaches, while a new municipal staircase is provided near the latter.

The new court is placed at the back of the building, away from the noise of the street traffic, and immediately around it are rooms for witnesses, jury, solicitors, barristers, and others connected with the business of the court, so arranged as to serve the purposes of both courts. The new Council-chamber is also placed in the rear, and over the court below. Near it are grouped the Mayor's parlour, the committee-rooms, Town Clerk's and Treasurer's offices, &c.

A special feature is made of the connexion between the old and new buildings on both floors,—on the ground floor by a new inner hall from which the court corridor opens; and on the first floor by a circular vestibule with a domed light, at the junction of the Council corridor and the present staircase. From this vestibule a new entrance is made into the banqueting-room, bringing it into suite with the Council-chamber, &c. Access for the public to the galleries of the court and Council-chamber is provided by a separate entrance and staircase from the proposed new market approach.

As will be seen from the view, the additions take the form of wings on each side of the Guildhall, with rounded corners at the return ends, marked by low flanking towers, and it is proposed to increase the importance of the centre block by crowning it with the low dome so characteristic of the style. Indeed, the whole question of style demanded the most special study and attention, it being considered of the first importance that the additions should so harmonise with the existing work that any impression of an after-thought should not only be avoided, but that the building, as a whole, should appear as if it had been so designed from the first, and, if possible, infuse the spirit of the old work into the new, while at the same time the importance and the dignity of the former should be increased rather than lessened as the central features of the whole composition.

The southern wing contains the new Municipal offices, and the northern wing the School of Science and Art, the sculpture in each rounded angle indicating the purposes to which they are devoted. The interior of the building will be carried out in harmony with the style of the exterior, and with the rooms of the existing Guildhall. It is, therefore, confidently hoped the result will be a work which, without any meretricious ornament, will, from the dignity of its treatment, proclaim itself essentially a public building not unworthy the architectural traditions or the civic home of such an historic city as Bath."

MOSAICS IN ST. MARK'S, VENICE.

THESE sketches represent St. Athanasius and St. John Chrysostom, two of the four Greek Fathers of the Church in the Baptistry of St. Mark's, at Venice. They were executed in mosaic by Greek artists of the twelfth and thirteenth centuries. In Mrs. Jameson's work on "Sacred and Legendary Art," she says:—"When they are introduced collectively as a part of the decoration of an ecclesiastical edifice, we may conclude in general that the work is Byzantine, and executed under the influence of Greek artists." They occupy the four spandrels of the vaulting, filling the same places here which are usually occupied by the four Latin Fathers in church decoration. Each has his name inscribed in Greek characters, and holds in his hand a scroll bearing some remarkable passage from his work in Greek. Thus St. Athanasius has "Often and anew do we flee to thee, O God," while St. John Chrysostom has, "God, our God, who hath given us for food the bread of life." St. Athanasius, the eldest of the Fathers, was born at Alexandria, A.D. 298, and died A D. 372. St. John Chrysostom was born at Antioch, A D. 344, and died A D. 407. The tympana between the spandrels are filled with mosaic work depicting scenes in the life of John-the-Baptist. The sketches are by Mr. Arthur C. Blomfield, M.A., and the original drawings were exhibited at the Royal Academy Exhibition of 1891.

THE "JEW'S HOUSE," LINCOLN.

THE illustration of this well-known and interesting old house at Lincoln (why called the "Jew's House" no one seems to know) is from a drawing by Mr. A. H. Powell, which was included in the exhibits of the Architectural Room at the Royal Academy last year.

"A MOUNTAIN CHURCH."

THIS is a study for a church in a mountainous district; the fall of the ground towards the east suggests the position of the heating-chamber, the vestry being placed over, reached by an external staircase. The accommodation is for 300.

The drawing was exhibited in the Royal Academy of 1891. G. Ll. M.

MAGAZINES AND REVIEWS.

THE *Art Journal* commences with an article on "An Etcher of Architecture," by Mr. C. Lewis Hind, the etcher in question being Mr. A. W. Haig, who well merits a post of honour in any artistic journal. The article is illustrated by reductions from some of Mr. Haig's etchings. We learn from it that Mr. Haig commenced with shipbuilding or making designs for and drawings of ships, and subsequently was a designer of buildings in the usual way of architectural draughtsmanship, before he took to the career which has given him fame. Mr. Hind rightly notes the special quality of Mr. Haig's etchings of buildings as giving breadth of effect without overlooking accuracy and minuteness of detail. The first of a series of articles by Mr. Aymer Valance on "The Furnishing and Decoration of the House" deals with floors and ceilings. In regard to some very good (and well-known) ceiling papers which are illustrated, the author rightly points out that a ceiling decoration should have no tendency of line in one direction. "Sir Joshua Reynolds and his Models" is an interesting paper by Miss Frances A. Gerard. The first example of the promised stories, "The Sculptor's Mistake," is not very attractive *quâ* story; the illustrations are the best part of it.

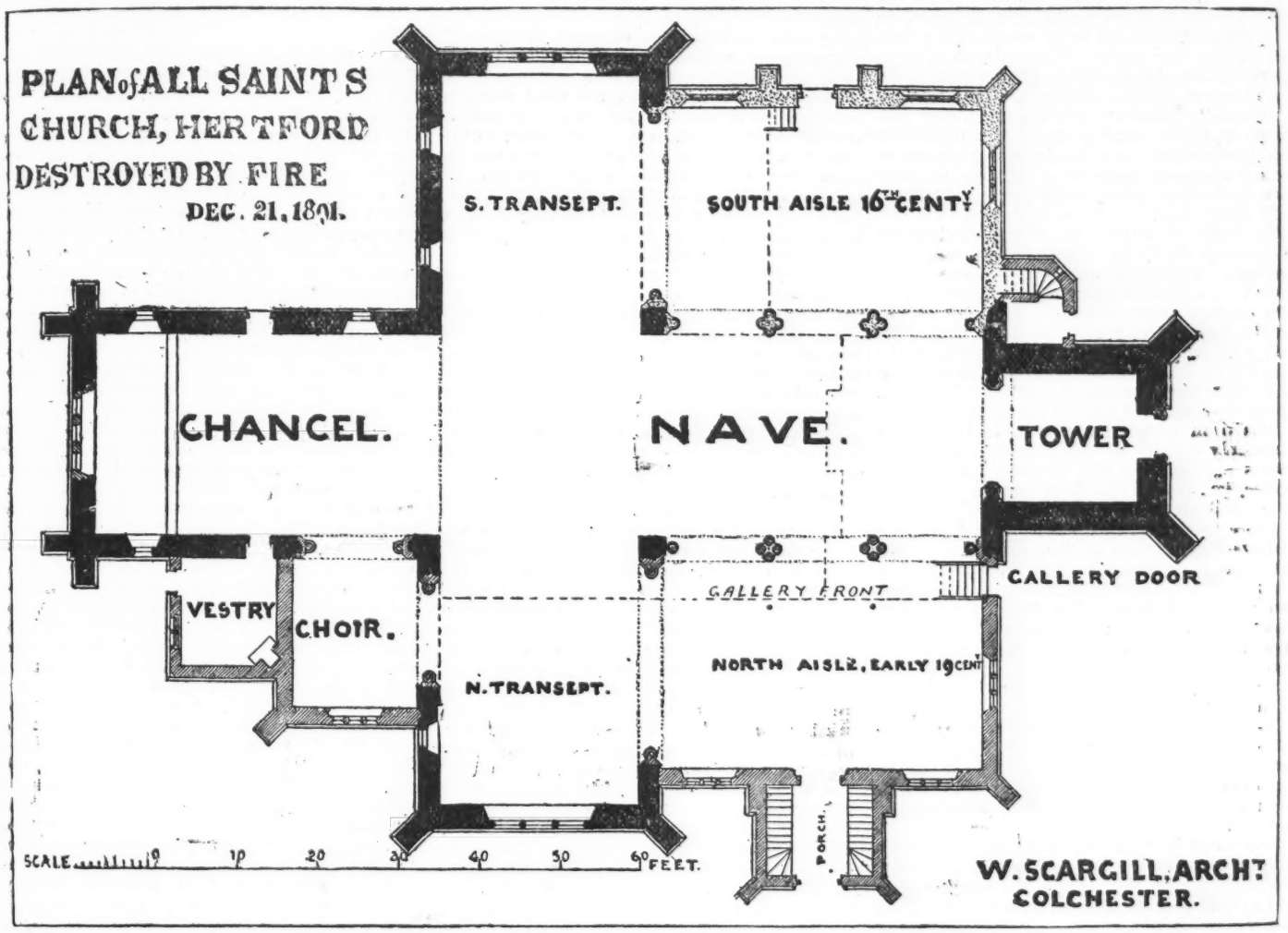
In the *Magazine of Art* Mr. Reginald Blomfield starts what we presume is to be a series of articles on "Artistic Homes," illustrated by his own sketches of his friends' houses, and containing many good and pointed remarks as to house-designing. An article on "Book-edge Decoration," by Mr. S. T. Prideaux, touches a subject which has been rather overlooked, and gives several interesting illustrations from examples in the British Museum. We certainly cannot agree with him in thinking that landscapes painted on the edges of the pages form "the most attractive form of edge decoration;" on the contrary, nothing could be more out of place, in spite of old examples. An article on John Russell, "the Prince of crayon portrait-painters," is illustrated by a frontispiece from one of his works, a portrait of a lady. Russell was born in 1711; the article, by Mr. G. C. Williamson, is mainly biographical, and contains a good deal of interesting information. The whole number is a very good one.

Among things in *The Antiquary* which will interest our readers are "Latest Discoveries at Mycenæ" by Professor Halbherr; "Notes on the Lights of a Mediæval Church," by the Rev. F. W. Weaver, and "A List of the Inventories of Church Goods made temp. Edward VI," by Mr. W. Page.

The Architectural Review, of Boston, which is a successor to or expansion of *The Technology Architectural Review* to which we have several times referred, commences with an article on the late J. D. Sedding, by Mr. Ralph Adams Cram, which is sympathetic and enthusiastic, but errs in the way so common among a certain school of writers on architecture, of speaking with contempt of architects who are not, like Sedding, seekers after originality at all costs. Mr. Cram must be very ignorant of the subject to say that Barry was an architect of mere archæological exactness, and refer to his Parliament houses as therefore an anachronism. Has he never heard that the style of the building was imposed upon Barry by the Government? Barry was a very original architect, using Renaissance materials after his own fashion, and American critics had better learn something more about his works before they sneer at him. And we would also suggest to the editor to take the trouble of getting English architects' and artists' names correctly; we find references to "Mr. Bigg's" drawings of Lincoln in our pages, a design for a frieze by Mr. Arthur "Gwatke," and a "Beaford" grammar-school by Mr. E. C. "Robbins." Apparently the writer of the article cannot even read print correctly. He also describes an Academy drawing of Mr. Batley's as by Mr. "Bailey," and shows his perception by describing the panel, published in the *Builder* of November 21, as "a perfect orgy of design," "bad taste," &c., &c. The design, a pretty little unpretending relief in gesso, will be remembered by many visitors to the Architectural Room of the Royal Academy, who will probably be rather astonished to hear of its being an "orgy of design."

IN *Harper's Magazine* Mr. Besant's "London under Charles the Second" is the most interesting of these historical articles that we have seen. It is confined to the city and popular life, leaving on one side the manners of the Court, which Mr. Besant thinks had little effect on the general life of the middle classes. He has got hold of an old housekeeping account-book of a middle-class family from 1677 to 1679, from which most realistic details are obtained. Details as to the Plague and the Fire of course occupy a good deal of the article, which is also illustrated by some very pretty sketches of bits of the London of the period. An article in the same number by Mr. Julian Ralph, on "Our Exposition at Chicago" gives a good idea of the immense and ambitious scale on which this great show is being carried out. The manufactures' building itself is one-third of a mile long. The combination of water with the architecture will, no doubt, add much to the effect of the scene. According to the writer, the English section is to include a reproduction of some notable English mansion or manor-house.

Scribner devotes an interesting article to some "Correspondence of Washington Allston," the American artist of the early days of this century, whose name is probably little remembered among English lovers of art at present, but who was a man worthy to be had in remembrance on account of his general intellectual culture as well as the beauty of his design in figure subject; some of his sketches are given as illustrations; one, of the heads of angels from a picture of "Jacob's Dream," is notable for its Raffaellesque grace of outline.



Allston visited and remained some time in England. His remarks on some English painters of the time are curious to read now, as instances of the different manner in which artists are seen by their contemporaries and by posterity. Northcote was a great painter then; and of Fuseli Allston observes that his picture of Hamlet and the Ghost was "alone sufficient to immortalise him." Haydon had a great admiration for that picture also: we know not where it is now.

The only paper in the *Century* dealing with art is Mr. Stillman's on Andrea del Sarto, in continuation of the series of articles on Italian old masters. The article is a short one, and gives a fair estimate of Andrea's powers and weaknesses. Mr. Stillman also reminds us that Andrea del Sarto was one of the artists who produced the model of the façade for the Duomo of Florence at the time of the visit of Leo X. It was produced conjointly with Sansovino, and one may naturally think that the latter had the most to do with it; Mr. Stillman observes however that "the masterly knowledge of perspective shown in some of his frescoes would suggest such a knowledge of architecture as most of the painters of the period possessed." The article is illustrated by engravings from two of Andrea del Sarto's works.

The *Nineteenth Century* of this month contains an interesting article on the "Electrical Transmission of Power," by the Earl of Albemarle, which repeats, quoting from M. Figurier, the pleasant fable that the reversibility of the dynamo was accidentally discovered. The article will give to the general reader a vivid idea of how a dynamo is a source of power, and when power can be transmitted electrically over a long distance. It is singularly free from technicalities, and is written in a powerful and graphic style. We feel particularly grateful to the Earl for the epigrammatic phrase, "vested interests and invested cash." Unfortunately the author resuscitates the notion disposed of by Mr. Swinburne two years ago, that a motor should have a relatively large armature. Small field magnets may be a necessary evil in motors for driving electric launches and tramcars, but the advantage in weight is gained at the cost of diminished electrical efficiency.

The Portfolio for this current month contains the first of a series of articles by the Reverend W. J. Loftie, upon a somewhat well-worn subject,—the Inns of Court. In reviewing Mr. Loftie's "History of London" a few years ago,* we had occasion to point out the absence of any logical principle of architectural thought or criticism from that work. In inveighing against the mischief which followed upon the first outbreak of the great Gothic revival, he would adopt,—

> A recent suggestion, namely, that in writing or speaking of modern, or mock, Gothic, as distinguished from the real thing, the term Vandal or Vandalic might be used.

He triumphantly asks what name can be more appropriate for Mr. Pearson's use of what he would persuade us is Gothic at Westminster? As he says that "even ordinary Gothic only exists in the Savoy and at Westminster," we infer that by "Westminster" he means the Abbey; in which case we are sorry for one who would stigmatise as Vandalism the recent work by that architect upon the exterior of the north transept. Possibly, however, he means to refer to the treatment of Westminster Hall, in which case we are with him. The "kind of garret," by the way, into which, as Mr. Loftie complains, some monuments have been removed at the Temple is, in fact, the triforium of the Round Church there. The article, however, is mainly concerned with topographical matters, in respect whereof Mr. Loftie treads upon surer ground. The complex story of Portpoole,—site of Gray's Inn,—is dismissed in thirty lines. It begins with a derivation for the name, thus:—

> But the "port" which means, in this connexion, rather an extra-mural market than a gate, may be found, perhaps, in the neighbouring Staple Inn . . . . and the pool,—well, what can be more natural than that a horse-pond adjoined the market-place? (!!)

It ends by saying that the manor came to the crown at the Dissolution, but Henry VIII. renewed the lease,—which must now be taken as correct: and that "the Treasury still pays the rent to the Crown." It is quite clearly set out in Mr. W. Ralph Douthwaite's "Gray's Inn,"† that the society bought, in 1733, their fee farm rent (6*l.* 13*s.* 4*d.*) from parties deriving title from Sir Philip Matthews' co-heirs, and have held the property free from any rent or charge ever since.

The *Health Record* (Dublin) is a new Irish Journal of Sanitary Science, to which we wish success. The short articles on various sanitary subjects are written in a sensible spirit. We learn from it that the Corporation of Dublin have adopted the report of the Main Drainage Committee, and the *Health Record* recommends the Dublin authorities to economise, if they like, in other matters, but to lose no time in carrying out a main drainage system for Dublin.

PLAN OF ALL SAINTS' CHURCH, HERTFORD.

WE are indebted to Mr. Scargill for the above plan of All Saints', Hertford, the destruction of which was referred to in our "Notes" and in Mr. Scargill's letter last week.

FIXING PORTABLE RANGES.

WE are here speaking of kitchen ranges which have all the flues constructed in iron and made part of them, and which are sometimes called independent, or self-setting, or more commonly called "American" ranges. This style of range was introduced from that country, where it was found of the utmost service to pioneers and settlers, being independent of brickwork fixing, ready for use almost at a moment's notice, and being made of light metal they could be treated as an article of furniture. They are used in great quantities exactly in this manner at the present day.

In bringing this range into towns or cities, as was a matter of course when they were introduced into England, many new circumstances were encountered, the chief of these being the chimney opening and the brick chimney, and, strange as it may seem, these ranges which are so very simple to put up, and need so little labour in so doing, are as great sufferers as our brick-flue Leamington ranges in working badly through incompetent work in fixing.

Doubtless these portable ranges suffer through its being considered that they need no fixing, as the flues are already made. This is correct so far as the flues around the ovens and boilers are concerned, but unfortunately many workmen have a very imperfect notion as to what

* See the *Builder*, February 2, 1884.
† Reviewed in our columns on April 17, 1886.

the "draught" is which impels the flame and heated gases through these flues in question; and, unless the range is in sound and proper communication with the chimney, the flues in the range will be of little use in assisting efficiency.

As every skilful range-fixer knows, the "draught" (without which every close fire-range would be utterly useless) is created in the chimney, and no range has ever been known to act correctly without a chimney of some sort, and they must be in proper connexion with each other.

To illustrate to what an extent carelessness enters into the fixing of these little ranges, it has been no uncommon thing to find one simply thrust into the chimney opening, with, say, two or three feet of flue-pipe placed on the nozzle, which is at the back of the hot-plate, and nothing else done except cementing the opening round to make it tidy. In such a case as this the range proves the worst of failures, as the up-current of air, the draught, all passes in the open mouth (or throat, as it is more commonly called) of the chimney, and none passes through the fire to carry the flames, smoke, &c., around the flues, and, in fact, it is found difficult to keep the fire alight.

There is one necessary feature in fixing any and every description of close fire-range. That the range must be fixed air-tight, so that every particle of air which passes into the chimney, and which constitutes the draught, must first pass through the fire; there must be no openings, crevices, other flues, or passages leading into the range chimney so that air can pass in without being heated by first passing through the fire. A copper flue running into the range chimney is permissible, provided it has a well-fitted damper in it, so that when the copper is out of use the damper can be closed; when the copper is in use no ill result occurs, as it is adding its proportion of hot air to keep up the draught.

The range just spoken of as an illustration failed for want of a covering-in-plate,—a plate extending across the top of the opening from side to side and front to back, a hole being cut in it to fit tightly round the flue-pipe, and a door being provided for the sweep to operate through and for ventilation or other purposes. The addition of this plate would have caused the pulling power (as it may be called in this instance) of the draught to exert itself wholly through the fire, and instead of the fuel being in a state of half combustion, it would burn fiercely as in a furnace, and the flame will be travelling through the flues at great speed with a roaring noise, which, however, can be instantly checked by the damper.

This is how every range should work if the conditions are normal, particularly iron-flue ranges which are expected to work a little more sharply, as there is no separation between parts and consequent leakage of air, as between the brick and iron work of brick-flue ranges. If a range does not work in this manner then there must be something wrong, but it does not follow that the range-maker is to blame, though no doubt some makes of ranges need a more complex method of fixing than others.

It is not very common for portable ranges to be fixed so that they will not work at all, as the majority of workmen know the need and use of the covering-in plate spoken of, but it is quite common for these ranges to be found working sluggishly, that is, taking an unnecessary long time to cook what is put in the oven, or on the hot-plate, the fire being rather dull, and the flues being quickly full of soot, which collects under the hot-plate in festoons, and the flues need sweeping almost daily instead of once a week. In a case like this it can with every confidence be stated that there is a leakage of air into the chimney somewhere, that is, the draught in the chimney is not wholly coming up through the fire.

If the range is newly fixed, it may be caused by the covering-up plate not fitting tightly round the edges, or the hole in it for the flue-pipe is badly cut, or it may be a copper or other flue running into the kitchen chimney, or a hole or aperture somewhere. It will undoubtedly be found that there is an opening at some point more or less easy to find that is causing the mischief. If the range has worked well, and then suddenly fails, it may be some of the soot-doors left out of place, the door in the covering-in plate left open, or some such oversight, unless some accident has occurred. The best way to discover leakages is with a lighted taper; by holding this to suspected places, the flame will be drawn in if there be an in-current of air. Sometimes a range will work well when a leakage is known to exist, but this only happens when the chimney is high and very efficient, and can work the range well with its draught somewhat reduced.

Frequently these ranges are fixed standing out in front of an existing range,—one of the old pattern open ranges most probably; in this case it is much the best plan to carry the flue pipe from the portable range through the chimney-breast above the mantelshelf, and have the original chimney opening stopped across the top with a covering-in plate, as described before; if, however, there is a positive objection to carrying the flue pipe through the breast, then it can be carried up through the covering-in plate; but, in any case, everything must be air-tight. This cannot be too strongly insisted on. The joints in the flue pipe, and the joint where the pipe fits on the hot-plate nozzle, must be made sound. Common glaziers' putty is the very best article for jointing purposes, but the surfaces should be painted or Brunswick-blacked before the putty is applied, to make it adhere. Putty hardens with heat, and makes a really successful joint for all purposes like this.

Sometimes the front of the old existing range and the opening is entirely covered over with a large iron sheet, and the flue-pipe is just carried through a hole in this. This is a very inefficient method, as it is next to impossible to make this large sheet tight-fitting round the edges, and then no provision can be well left for the sweep, except by moving the sheet, which the sweep will not trouble to replace as securely as it should be. If the front of the opening containing the old range must be covered, let a loose covering be used, but have a covering-in plate fitted inside as recommended.

If a portable range is fixed in front of an existing close-fire range or kitchener, there is a little feature which needs attention, and which may very readily be overlooked. This is the possible bad state of the brickwork flues behind the kitchener. If these are out of order, it is possible that the chimney will manage to draw air through this direction, to the prejudice of the small range, and it becomes very desirable to see that the range behind the portable one is air-tight everywhere before good results can be expected. In the same way, if a portable range is fixed in an opening from which a kitchener has been removed without pulling down the old brick flues at the back, these flues should be filled up solid with concrete or some such material.

In alluding to the frequency with which portable ranges may be found working sluggishly, let it be clearly understood that this is never, or hardly ever, connected with the height or build of the chimney. What has been spoken of is a sluggishness that is perpetual, no one day giving better results than another. If the range should work well sometimes and badly at others then the trouble cannot be overcome by any of the suggestions yet made; the fault will be most probably due to the chimney itself, which will be found to be subject to down-draught with more or less intensity at certain times when the wind blows from certain quarters. Of course, irregular results are oftentimes occasioned by irregular attention in cleaning the flues.

When a portable range is worked out in the open-air, as in military camps where there are no high surroundings, it is astonishing what a short length of pipe will act efficiently as a chimney. The writer saw some at Hounslow which were fitted with handles for convenience of removal from spot to spot, and these were working their very best with 10 ft. of 8-in. iron pipe for a chimney, but to do this it must be seen that all the joints in the range itself as well as in the pipe were well-made and sound.

Iron pipe flues for these ranges should be 7 in. for 30 and 36 in. size, 8 in. for 42 in. size, and 9 in. for 48 in. size or larger. Some may consider these sizes too large, for there is a strange notion prevalent that very small pipe flues will answer. These sizes are none too large, for the largest mentioned is smaller than a 9-in. square brick chimney, and no builder would think of building less than a 9-in. chimney for the smallest cottage range. Every joint in a pipe chimney must be made perfectly tight.

If desired two of these ranges can be worked into one 9-in. chimney, and will work perfectly, provided each has a well-fitting damper that can be tightly closed when either range is not in use.

THE SANITARY INSPECTORS' ASSOCIATION.

THE annual presidential address to this Association was delivered on Saturday evening, the 2nd inst., at Carpenters' Hall, before a large audience, by Dr. Richardson, the main subject of the address being the change which during the past year has taken place in the constitution of the Association. The Association must be congratulated on having, at so early a period in its existence, become practically an incorporated society, or, to speak more exactly, a society limited by guarantee. Very rarely had any society so young been so greatly honoured. But the change brought with it increased responsibilities, and in carrying out the powers given to them in their articles he thought their first efforts should be to make a school—a thoroughly practical teaching school. Lecturers might be got and work commenced by next October. The President thought the programme of studies should include six subjects, but two of these were not of immediate necessity. The four necessary subjects were in order (1) Physiology,—not the teaching of the dissecting-room, though it should be of a serious, if popular, character; (2) Natural History, with microscopical studies; (3) Chemistry, with a well-fitted, if small laboratory, where research would be practicable independently of the school programme; and (4) Hygiene, their own proper study, the laws of health. The two eventual subjects were "The Theory of Hygiene," which would present the philosophic side of the matter; and lastly, what had been called by Dr. Despéné, of Marseilles, "Moral Hygiene," for which they could at present probably get no teacher and no class, but which might in the end prove to be the most beneficial of all. It might, perhaps, enable them to go so far as to undertake the cleansing of the world from all uncleanliness. The lecture concluded with a retrospect,—a stocktaking of matters hygienic. English people often reproached the Continentals with neglect of practical sanitary measures, and we had now the French throwing back upon us the reproach, and retorting that we had done nothing to reduce the fatalities from disease, and had not touched epidemics. Whether the charge was true or not, could not be certainly known until we got the complete statistics of the last census, which would not be for another year. From an analysis of the statistics of the previous census, made by Sir E. Chadwick and himself (Dr. Richardson), it was found that in two classes of causes of death there had been not progress, but retrogression, although in the remaining classes improvement was shown. Taking each 100 deaths from 1847 to 1880, there were from zymotic diseases of all kinds 23·26 in the former year, and only 20·09 in the latter,—an important reduction. Deaths from consumption had also diminished from 12·67 per cent. in 1847, to 9·12 per cent. in 1880, and from diseases of the digestive organs, from 5·82 to 4·74. There was also a slight diminution in all other classes of causes of death, except the two already mentioned, viz., "brain and nervous diseases," and "respiratory diseases other than consumption." The latter, which stood at 12·14 per cent. in 1847, had risen in 1880 to 17·78 per cent., and the former had risen from 11·54 to 13·12. The reduction in the case of the spreading diseases was no doubt due to improved sanitation, drainage, and water supply, and the cases of consumption to the fact that people were better housed and better fed. Why there had been an increase in the case of the other respiratory diseases he could not tell, but that due to brain disorders was easily enough accounted for. Would there be an improvement for the decade 1880-1890? He would say Yes, with regard to consumption, not on account of improved methods of treatment, but because people were able to get better food, and because they had better sense. The increased numbers of those who played lawn-tennis, and particularly of those who practised cycling, had been the most fruitful causes of progress; and the chief cause of the retrograde movement was, in his opinion, that *ignis fatuus*, the germic theory,—or rather the search for germs in all diseases. Good minds were led astray from seeing the paramount importance of cleanliness, from the principles established by the Board of Health, from the necessity of rapidly getting rid of excreta, of removing all obstacles from our streets, of systematising our methods of road-making to save man and horse, both great sufferers by

finding here wood, there stone, and in other places macadamised roads, instead of one general system of pavement. It was possible that the retrogression might be found to have gone on during the last decade, and with regard to the unfavourable movement in other respiratory diseases, there was much room for doubt. Some people believed insanity to be on the increase; suicides certainly were, and it appeared that cancer was becoming more and more fatal. The greater activity in political and literary matters, the increase of ambition, and the race for wealth obviously introduced severer strains, and accounted for the retrogression in the class of nervous disorders. One respiratory disease,—influenza,—which was baffling all the doctors and sanitarians, might perhaps be due to cosmic causes. Here they must all bend low and look for more light. The members of that Association could be depended upon, in the meantime, to go where it was their duty to go, and do what they thought best to be done to check disease, and, in conclusion, he wished them every success in their important work.

A discussion followed on the proposal of a vote of thanks, in which Mr. Perry (Hon. Member), Mr. Coulson (Inspector, Chelsea), and Mr. Hugh Alexander (the Chairman of the Council) took part.

The vote of thanks was passed with warm acclamation, and Dr. Richardson briefly replied, explaining in doing so that he wished not to be misunderstood with regard to his remarks upon the germic theory. He did not deny the existence of germs nor their influence in one or two small classes of diseases, but he regretted that these discussions led to little practical result, while much practical good that might be done was neglected in theoretical discussions which absorbed energies that would be prolific in good results if devoted to the real battle against disease, and to improving our drainage and increasing public cleanliness.

During the proceedings, the death of Lady Chadwick (widow of the late President) and the cremation of the body at Woking were mentioned, and a resolution was carried asking the President to continue negotiations which were already in progress for a four days' visit to Paris at Whitsuntide, to hold the annual conference of the Association in that capital on the invitation of the most important Sanitary Association of France, namely, that presided over by the veteran sanitarian, Dr. Pietra Santa.

THE POLYTECHNIC INSTITUTION.

THE annual Industrial Exhibition of the Polytechnic Young Men's Christian Institute, which has been open since the first of the month at 309, Regent-street, and will remain open until the end of this week, admirably shows the wide extent of the work of this institution, under the guidance of Mr. Quintin Hogg, who generously devotes many thousands of pounds annually in furtherance of the objects of the Institute. The exhibition appears to show the work of the students in the various classes during the past year, and to this is added many specimens of the work of members who, though they may have been students once, are now more advanced. Though a distinction is made in the catalogue, it would have been more interesting if the arrangement of the exhibits had more distinctly marked this difference. Of the technical exhibits, the most interesting is undoubtedly the mechanical engineering work, and, considering that much of this has been done by students of eighteen or nineteen years of age, under the guidance of one technical instructor, Mr. Rogers, the result is an exceedingly good one. The exhibits include pumps, lathes, dynamos, engines, and tools of various descriptions. The leadwork shows the usual difficulties of bossing and soldering leadwork successfully overcome; and adjacent to this exhibit is an example of cut and rubbed brickwork, showing a niche head and various capitals carefully expected, though somewhat lacking in vigour of design.

The exhibits of bootmaking, tailoring, harness-making, and carriage-building are interesting, though they cannot here be alluded to in detail. The furniture is entirely by members, and not by students, and is an interesting collection, in which the workmanship far exceeds the design. On a screen in this room are some most interesting sketches by Messrs. Herbert Railton, J. Pennell, C. W. Wyllie, and Alfred East, and others, which have been lent for exhibition by Messrs. Cassell & Co. The joiners' and carpenters' woodwork exhibited are the usual specimens of joints and handrailing which are set as exercises for the students. There is a large collection of drawings prepared in the building construction classes, upon which an immense amount of care seems to have been bestowed, and the construction is clearly shown. One case, however, of a cornice-stone, shown in section, appears to be sadly lacking in "bed," and would inevitably over-balance itself were it constructed as it is shown. There are several sets of designs submitted in competition for the Spencer Chadwick prize, the subject being a block of flats; but there is a singular lack of artistic conception displayed throughout. Though the exhibition is mainly the work of students, and as such must not be judged from too high a standpoint, we would call attention to the fact that there seems a great deal of room for improvement in the designs displayed, especially in the architectural drawings and in the furniture, jewellery, and other articles where, with every advantage, beauty of form might be allied with precision of workmanship. It appears that at present more attention is given to the latter than to the former, and we would commend this point to the careful consideration of Mr. Quintin Hogg and his colleagues who are interested in the capital work which this Institute is no doubt doing. One of the most interesting portions of the exhibition is the collection of steel and iron work and goldsmiths' work, lent from the South Kensington Museum collection.

Correspondence.

To the Editor of THE BUILDER.

THE FUTURE BUILDING ACT FOR LONDON.

SIR,—It is understood that among the many and extensive modifications in the Building Acts suggested by the County Council, there is one which affects the vacant space to be left for the use of buildings for light and ventilation. As this is not simply a proposal for allotting more space, but also introduces a new system of determining that space, it ought to be very carefully considered by all interested in London buildings. Its results are sure to be to some extent a surprise, and it appears likely to be far-reaching in its operation.

The new principle is that an imaginary plane is to be drawn from the back of the site at an angle of 45 deg. to the horizon (our old friend the angle of forty-five having lost credit of late with lawyers, has found some one fresh to take it up), and this plane of 45 deg. is to form a limit which the building is not to pass. Circumstances have caused me to consider what the effect would be on a good class of property, —say houses approaching 100*l.* a year rent, and it appears that it is likely to excite an injurious influence directly by the alterations which would have to be introduced into the design, and indirectly by the changes that might be made inside to avoid the pressure of the enactment; and when I say an injurious influence, I mean an unsanitary one.

It will, of course, be remembered that by this rule no part of a building can be higher than its distance back from the starting point, —*e.g.*, 20 ft. back allows 20 ft. high, and no more. Now, *primâ facie*, it appears inconsistent that the same Act should allow the *fronts* of houses to be as high as they are distant from the points of opposite buildings, while the *backs* (supposing two rows of houses parallel and back to back) will have to be twice as far apart as they are high. Yet this would be the result.

Let us suppose a house of a basement and four stories planted, as many good houses are, so that the basement-floor is level with the back-yard or garden, the front road being on arches. If the house is 55 ft. high at the back, and the back land 45 ft deep or less, the top rooms at the back would have to be entirely dispensed with, yet these would be the best-lighted and best-ventilated rooms in the whole house; but for sanitary reasons (!) they must go. If the room or rooms cannot be spared, they will have to be added above the back addition, with the result that they themselves will be less well ventilated and worse lighted; that they more or less must overshadow windows of other rooms at the back, making those rooms less healthy; and that they will turn a back staircased window into a door, darkening the staircase, and depriving the lungs of the house of part of their supply of air.

Supposing a "tight fit," the method to which a builder of such houses could have resort in order to get his building into his site, would be diminishing the height of his stories, sinking his house into the ground, diminishing the width of his front area, and keeping up the level of his back-yard or garden Every one of these expedients would diminish the healthiness of the house. I hardly think the Building Act Committee of the County Council can have foreseen all this, which, however, follows naturally from this proposal.

A DISTRICT SURVEYOR.

TOTNES CHURCH.

SIR,—"Viator," in his reference to rood-screens in last week's *Builder*, through a want of accurate information as to the details of restoration of the above church, has conveyed an incorrect impression. He says: "The great rood-loft has been destroyed within the last three years"; makes mention also of an eastern screen of oak as though that had been demolished at same time; and adds, "Meantime a hideous north gallery remains."

An acquaintance of over thirty years with the church,—one of the handsomest in the west of England,—enables me to give reliable facts in this matter. The works of restoration, under the superintendance of Sir Gilbert Scott, and latterly of his son, which extended over a period of twenty-two years, were completed in 1888, nothing at all having been done to the fabric in *the last three years*. The beautiful rood-screen of stone is the most conspicuous feature of the interior, traversing its full width, an elaborate network of tracery, but lightly proportioned so as to present the least possible obstruction to the view of the chancel beyond. I well remember a gallery with high pews which, previous to 1870, bridged the church, topping this screen and resting on iron supports in the chancel; its floor *may* have been identical with the original rood-loft, but was quite a wreck after seventeenth-century "vandalism"; if an eastern screen of oak ever stood here it was at a period beyond the memory of any living inhabitant. This gallery shared the fate of the other galleries with which the building was encumbered; for all were removed in or soon after the year mentioned. The stair to the rood-loft still remains, though closed up with an ornate entrance; and to north and south there is a parclose of stone. A considerable sum was spent on the screen itself, the dilapidated stonework being repaired and re-instated, and the whole decorated in harmony with the old colouring which could still be seen. As to a "hideous gallery remaining," the only ground for such a mis-statement can be that in an outer north aisle, built at the time of the restoration, a small gallery was placed to provide needful accommodation; it is not in any sense prominent, and the front panelling, which corresponds with the architect's other designs, is quite the reverse of unsightly.

Your correspondent says, "Perhaps the Vicar of Totnes will explain." My reason for sending these few lines is that the late Rev. J. W. Burrough, who was the animating spirit throughout the very arduous undertaking of restoring so large a church, was well known to me. The fifty years during which he was vicar have indeed left their mark, and he will long be remembered as one who exhibited in himself a happy combination all too rare,—faithfulness in the discharge of parochial ministrations and unwavering loyalty to evangelical principles, with a zeal that could not allow neglect of the "earthy sanctuary," but by reverent care must make it worthy of its sacred purpose. It is fitting that his devotion to this object should thus be put on record in your journal, especially as his sympathies were ever with "conservative" restoration. He entered into rest in 1888, and the towering walls of his old church overshadow his grave.

DEVONIENSIS.

SOFT TILES.

SIR,—Can any reader tell me of a preparation to render the surface of soft paving-tiles hard and incapable of forming a fine dust, which finds its way from the kitchen throughout the house?

DUST-HATER.

THE ENGLISH IRON TRADE.—After the holidays the English iron market is naturally quiet, and the unfavourable character of the Scotch and Cleveland ironmasters' returns will retard any forward impetus. Prices, however, do not exhibit any material reduction. There is a better demand noticeable in the hematite iron trade of the north-west. Manufactured iron is still in moderately good inquiry; and in steel rails there is a slightly better tone, but the steel trade generally is quiet. Tinplates show an improved tendency. Engineers and shipbuilders are fairly well engaged. The coal trade, on the whole, is moderately busy; and in South Wales fair shipments have been made, in spite of the stoppage of the pits which was threatened, the crisis, however, being fortunately averted.—*Iron.*

The Student's Column.

WARMING BUILDINGS BY HOT WATER.

II.

HEAT: RADIATION (*continued*).

THE following table shows the comparative radiating powers of substances. The absorbing and radiating powers of materials are equal, so that the table applies either way. The reflective powers of surfaces are in exact inverse ratio to the above; for instance, lampblack, which stands highest in radiating power, is practically devoid of reflecting power, as everyone knows. Polished metals, however, stand high as reflectors, but would give poor results as radiating media. A homely illustration is the copper kettle, which loses heat rapidly when dirty (the metal being an excellent conductor), but when polished the loss is reduced to a minimum.

Radiating and Absorbing Powers of Substances.

Lampblack	100
White Lead	100
Glass	90
Cast-iron, untouched	70
,, polished	32
Wrought-iron, polished	30
Lead, tarnished	45
,, clean	19
Zinc ,,	18
Brass, clean, rough	12
,, highly polished	7
Copper ,, ,,	7
Silver ,, ,,	3

Lampblack answering so well as a radiating material has led to the belief that colour affects the radiating power of substances, but this is not the case with dark rays of heat, such as we get with all hot-water works, and from all non-luminous bodies.

The radiating power of a body is not due to its substance, but to its extreme external surface, we may say, its skin. Lampblack, painted on, is very perfect as just mentioned. If this material composed the whole substance of the pipes, the effect would be bad, as being a poor conductor, the heat would not get through to its outer surface to be radiated. The high radiating efficiency of white lead points conclusively to paint being a very suitable material to apply to any exposed radiating surface which cannot be left untouched or coated with lampblack. All paints, particularly those whose colours consist of metallic oxides, answer exceedingly well, but they should be laid on thin, for the materials of paints are not all good heat conductors, and no barrier, however slight, should exist to prevent the free escape of heat where it is desired. Undoubtedly lampblack, applied as a water colour, gives the best results if appearance has not to be studied; an application of this material to the silver pipe referred to would overcome the trouble mentioned.

There is a fancy for bronzing pipes and radiators, especially the latter, but although the effect may be liked as regards appearance, the results in regard to radiation are bad. All bronze powders, also gold leaf, and metals electrically deposited, are practically bright metallic surfaces, which have been already pointed out as being bad radiators. They are less efficient than varnished or painted surfaces. If a radiator or coil which is in use be half-bronzed and half-painted black, the difference in heat radiation from the two different surfaces will be actually perceivable to the hand or face, if tested at about 12 in. distance. In making an experiment like this, however, it must be first ascertained that the actual temperature of the radiator is alike all over; this is not always the case.

From the table quoted it will be noticed that glass is a good radiator of heat; whatever heat it absorbs, it parts with readily. This by itself might bring glazed porcelain and Doulton ware radiators into use, and which would be exceedingly pretty; but there is another point to be considered in the fact that the material of the pipes and the glazed surface itself are all poor conductors of heat, and would, therefore, give but little chance for the outer surface to show its radiating efficiency. Probably something of the sort may be successfully brought into use some day. It would be worth doing, for radiators, although decided improvements upon coils, are capable of being improved upon also, and to a considerable extent. Stoves are made in earthenware, and have a very handsome appearance; but the higher temperature of fire heat can be more easily dealt with than that which we get from hot water. The former is retained, subdued, and tempered by the interposing poor conductor.

Before quitting the subject of radiant heat, special attention must be drawn to its non-effect upon the air. The radiant rays, as before mentioned, pass through the air without raising its temperature, and they only have effect upon whatever they come in contact with and impinge upon. From these objects that they encounter, there proceeds a re-radiation of heat, which also goes on without heating the air. The particular advantage of this is that human beings, as also most living creatures, benefit, and are also made comfortable by their bodies being kept at a good warmth, but at the same time breathing a cool or cold air,—air at a much lower temperature than the body enjoys. The extremes that this can be carried to are very great; this can be judged by the pleasure experienced in breathing the cold air of a bitter winter day, the body at the time requiring to be thickly clothed and of a temperature that is registered quite at the other end of the thermometer. Radiant heat, which is the most natural heat, fulfils this requirement by affording warmth to the surroundings, but without affecting the air.

There is, however, another good feature connected with radiant heat which, as it does not alter the temperature of the air, does not interfere with its proper degree of moistness. The moistness or saturation of the atmosphere has always to be considered in warm or hot-air works, and it has often to be provided for in works with exposed pipes.

It has to be explained that the air with every difference in temperature has a different capacity for water. The cooler the air the less water it requires or can hold in suspension, but in direct proportion as it gains in heat, it will imbibe moisture. If air has not a sufficiency of moisture in it, it is, to say the least, disagreeable, sometimes injurious, especially affecting those with throat troubles (as an east wind does, which also lacks moisture). Air, when saturated, contains water vapour as follows:—

Temperature of the air (Fahrenheit) Degrees.	Quantity of vapour per cubic foot. Grains weight.
20	1·52
30	2·16
40	2·92
50	4·19
60	5·76
70	7·77
80	10·59
90	14·15
100	19·00

The capacity of air for water is about doubled by each increase of 27 deg. F.

As explained earlier, a hot-water apparatus with exposed pipes furnishes heat in two ways, viz., by radiation, and by heating the air which has contact with the pipes, &c., and not by radiation only, so that, properly speaking, some provision should always be made to add moisture to the air which is warmed. This, however, is seldom done, and as seldom needed, for with exposed pipes, the chief of the heat is radiated; the little increased heat to the air can readily supply itself with moisture from many sources. It is usually sufferers from bronchial affections who can instantly discover a dryness of the atmosphere. In this case moisture can be furnished by pans of water placed on the radiators; some radiators have the top castings capable of holding water which permits of the air helping itself, and the water itself also evaporates slightly with the warmth.

CONVECTION OF HEAT.—This is the way by which heat is conveyed (actually transported) by fluids. This action is almost of greater interest to the hot-water engineer than either of the others treated, as it really accounts for the existence of his calling. Water and gases—in fact, all fluids, are composed of elements existing in the form of minute molecules, grains, or particles. It is very necessary to understand that fluids are composed of atoms, to account for the action of convection. There is not the slightest friction or cohesive property existing among these particles—in fact, there is supposed to be a slightly repelling influence amongst them, for gases and water will spread great distances if unconfined and experiencing no restraining influence. It is to be assumed that the molecules of water are spherical to account for the very free motion amongst them; and a point to be impressed upon the reader is, that the utter absence of friction permits of an exceedingly rapid motion being attained. It is sometimes a little hard to grasp this theory, as there are no solid and visible substances that act with a freedom any way approaching this.

There is a simple means of experimenting to ascertain and become familiar with the process of convection. Take a medium-sized glass jar or a wide-shaped bottle, and nearly fill it with water; then place or suspend it over a lamp,—a spirit lamp gives the greatest heat, but the action is quite sufficient if the vessel is held over the glass chimney of an oil lamp. Before, however, any visible results can be obtained, we must put some substance in the water that will make the motion obvious. The best material to put in the water is amber, which must first be reduced to a dust, a fine powder. This should be stirred in. Amber most nearly approaches the gravity of water, and it will be found that a good proportion of the dust particles will remain suspended in the water without motion unless agitated. By watching the movements of these particles we may ascertain exactly what is happening with the water, for every movement is indicated by the amber.

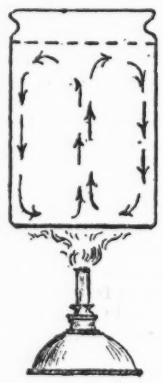


FIG. 3.

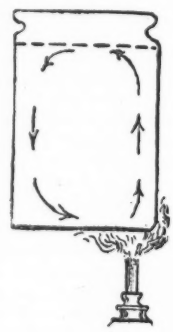


FIG. 4.

Fig. 3 shows the motion of the water, if the heat is applied to the centre of the bottom of the jar; if the heat is applied nearer the side the action is more as fig. 4. The exact cause of the action is as follows:—Before the heat is applied to the jar we may consider that the particles constituting the mass of water are stationary. Upon application of heat to the bottom we cause those particles which are in contact with the bottom surface to become warm, and as they absorb heat, they, like every other substance, to a greater or less extent, increase in size; that is, they expand when heated. When a material expands with heat it does not, of course, increase in weight, consequently it may be looked upon as a lighter substance while it is hot. This is the case with the molecules of water as they become heated; they increase in size but not in weight, and, consequently, are, bulk for bulk, lighter than their colder neighbours.

The result of this difference in weight is that the particles being so mobile and free from friction, the heavier ones instantly force their way below the lightened ones and cause them to rise. This is just the same action as takes place if we take a piece of wood or cork and plunge it into a vessel of water and release it at the bottom; it instantly ascends to the top, it being a lighter material than the water. Therefore, we may understand, and experiment will show, that immediately warmth is imparted to the water at the bottom, a circulatory action sets in, the warmed particles rising and cold particles taking their place, which also become warmed, and rising, give place to more, and so on. The circulatory action of water, and its application to hot-water pipes, will be dealt with in the next paper.

SOCIETY FOR THE ENCOURAGEMENT OF THE FINE ARTS.—The thirty-third annual report of this Society, for the year 1891, briefly chronicles the proceedings of the year, and appends the programme for the coming year. The *conversazioni* will continue to be held in the galleries of the Royal Institute of Painters in Water Colours, Piccadilly. It has been customary to hold the first *conversazione* in the month of January, but owing to the inclement weather which usually prevails at that time, the Council have decided to hold this *conversazione* at a later date.

BELLS, NORTHWOOD CHURCH, STAFFORDSHIRE.—Messrs. Charles Carr, of Smethwick, have secured the contract to recast and rehang the bell (weight, 22½ cwts.) at Northwood Church, near Bucknall, Staffordshire.

GENERAL BUILDING NEWS.

HORSHAM GRAMMAR SCHOOL.—The Governors of the Grammar School being about to erect new school buildings and residence, eight architects of repute were nominated, from whom they have selected Mr. Arthur Vernon, of London and High Wycombe, as their architect to carry out the new buildings, which are to be commenced in the spring.

SCIENCE AND ART SCHOOLS, HIGH WYCOMBE.—New science and art schools are about to be erected at High Wycombe, from the designs of Mr. Arthur Vernon.

NEW BUILDING ESTATE AT BIRMINGHAM.—The first portion of a large building estate, situated at Sparkhill, a suburb of Birmingham, has now been completed. The builders were Messrs. Hughes & Son, of Sparkhill. At Edgbaston, another large suburb of Birmingham, a number of villa residences of somewhat similar character to the preceding, but with wider frontages, have also been completed. The builder was Mr. Edward Airey, of Gillott-road, Birmingham. The architect of these was Mr. John Statham Davis, also of Birmingham.

RESTORATION OF WOODLEIGH CHURCH, DEVON.—For the past seven or eight months the Church of St. Mary, in the parish of Woodleigh, has undergone restoration, at a cost of 1,220*l*. The tower has been coped with granite, as it was found that the stones at the top were quite loose, and all the mortar was washed out. It has also been re-roofed, leaded, and pointed with cement. All the roofs of the building have been renewed, the inside showing oak boarding on a circular sweep, with oak purlin and ribs and bosses at the intersections. Inside the chancel roof has been treated the same way. The walls have been stuccoed with blue lias, these being previously covered with curious paintings in distemper. An attempt was made to preserve these, says the *Western Morning News*, but they have been so whitewashed over and over again that this was found to be impossible. Wood-framed windows have been replaced by granite, while those of stone have been renewed and pierced, the whole being filled with cathedral glass. What was known as the Hendham transept has been given up for use as a vestry and organ-chamber. The space underneath the tower, which formerly served for this purpose, is now converted into a baptistry. All the floors are tiled, and the pews, which have a flooring of Farr's patent wood blocks, are of red deal, stained and varnished. The chancel arch has been rebuilt, and quoined with granite. On the north wall of the chancel, a window, which has been walled up for years, has been opened, and the splays built with leaders and stretchers resting on granite sills. Within the chancel a rise is made by three steps of white Sicilian marble and encaustic tiles. In the north wall of the chancel there is an old eastern sepulchre, which has been preserved. Mr. G. H. Fellowes Prynne, London, was the architect; and Messrs. Farr & Sons, of West Alvington, were given the contract for the work.

COTTAGE HOSPITAL, HIGH WYCOMBE.—The High Wycombe Cottage Hospital has been recently enlarged and endowed with a sum of about 2,800*l*., granted by the trustees of the Earl of Beaconsfield Memorial Fund from the surplus at their disposal. The new buildings consist of a large operation and convalescent room, bath-room, heated linen-chamber, and other conveniences, costing, with additional piece of land, about 800*l*. The new buildings were opened by Mr. Coningsby Disraeli, the heir of the late earl, on the 19th ult. Mr. Arthur Vernon was the architect, he having been the architect also of the new buildings which were erected in 1875; and Mr. H. Flint, of High Wycombe, was the contractor.

NEW BOARD SCHOOLS AT PERCY MAIN.—The formal opening of new schools, erected at Percy Main by the Tynemouth School Board, took place on the 30th ult. The site, purchased from the Duke of Northumberland, is in one of the most prominent thoroughfares of Percy Main, namely, in John-street, and containing 2,500 superficial yards, with a frontage of 134 ft. 6 in., and a depth of 158 ft. Provision is made for 172 children in Standards I. and II., and for 166 infants, with arrangements for future extension to accommodate 108 more children. The main school is 60 ft. long by 22 ft. wide, with a central recess 22 ft. by 16 ft., and class-rooms at each end 20 ft. by 18 ft. At the west end are two infant's-rooms, the larger one (fitted with desks) 27 ft. 6 in. by 22 ft., and the smaller one (with gallery) 22 ft. by 20 ft. Care has been taken to supply the largest amount of light and ventilation. The desks and fittings are all of oak. The playgrounds are cemented throughout, and the children will have the advantage of covered sheds for wet weather. The contractors for the whole of the works were Messrs. J. & W. Simpson, of North Shields and Blyth, and the buildings, which include a caretaker's house of four rooms, have been erected from the designs and under the superintendence of Mr. F. R. N. Haswell, F.R.I.B.A., of North Shields.

NEW COTTAGE HOSPITAL AT LEDBURY.—Mr. Michael Biddulph, M.P., has given to the town of Ledbury, in commemoration of the coming of age of his eldest son, Mr. John Biddulph, a cottage hospital, at a total cost of about 3,000*l*. The new building is erected in a most commanding position in the town, and immediately opposite a dwelling-house in which the Ledbury Cottage Hospital was opened nearly twenty years ago. The new building is of the Elizabethan style, and in addition to offering all the requirements of a cottage hospital, there is attached to it the residence for a town nurse. Mr. Hadden, of Malvern, is the architect, and Mr. George Hill, of Ledbury, the builder.

THE BUILDING TRADE IN SCOTLAND IN 1891.—The *Aberdeen Free Press* reports that the building trade in that city during the past year has been "fully more prosperous" than during the preceding twelve months. "Fewer new buildings have been erected, but the operations have been all over, on a larger scale. This will be fully seen when it is mentioned that with an addition of about 170 new houses and cottages to the city, as against nearly 250 in 1890, there is an increase in the valuation of the town through the erection of these new buildings alone of 6,308*l*. 7s., as compared with 5,670*l*. for 1890. As a consequence, both the mason and joiner departments of the trade have been very fully employed. In the latter branch business was indeed exceptionally brisk during the summer months, and men were in great demand. This naturally led to a demand for a rise in pay. About the middle of May, therefore, and after the matter had been discussed by the trade 'Board of Arbitration,' the standard rate of pay was advanced from 6d. to 6½d. per hour, with 7d. and even 7½d. for very superior men. With the rise in wages, however, there was no corresponding rise in prices; competition has been tending, indeed, to become keener than ever, and as a result the profits of the employers continue to diminish. In fact, as one large employer in the city puts it, the masters begin to breathe an air of satisfaction when they find themselves clear on a job. The working day in the joiner trade, as among the masons, continues at the nine hours, and there appears to be no disposition towards a change on the part of either the masters or men. There is a feeling among the men, however, that another rise in wages might fairly be demanded about the beginning of the year; but it may be assumed that, before anything of the nature of strong measures are taken, the matter may be referred again, in the first instance, to the Joiner Arbitration Committee."——The *Dundee Courier* says that during the past year the building trade of Dundee has been exceptionally brisk, it being estimated that over 200,000*l*. has been expended in the erection of dwelling-houses and public buildings or on making additions to works in different parts of the city. From a public point of view, the principal undertaking has been the new Parochial Hospital in Mains Loan. The Old Asylum grounds, it may be mentioned, have been the centre of activity, some blocks of shops and dwelling-houses having been reared on the sites acquired from the Asylum Directors in Park-avenue, Morgan-street, Cardean-street, Albert-street, and Balmore-street.——The *Edinburgh Evening News* says that the year, on the whole, has been a satisfactory one from a labour standpoint. "Unskilled labour has been in fair demand, the works carried on in connexion with the Water of Leith Purification Scheme and railway extension having given regular employment to a large number of men, but our survey concerns workers of a superior grade, and it is gratifying to note that, in the main, the position of the artisan has rather improved than otherwise. With one of the most important classes, masons, a reduction of wage had recently to be endured, following, however, a previous increase. In the early autumn the standard wage was lowered from 8½d. to 8d., but, notwithstanding, the masons are financially better circumstanced than they were twelve months ago, and that things seem to have an upward tendency seems to be shown by the statement of one of the leading firms in the city that if they were asked to estimate for fresh contracts the possibility of increased expenditure in this department would be taken into account. The distinguishing feature of the past year from the builder's outlook has been the comparative absence of fluctuation, no congestion having occurred, in the first instance, because the openness of the weather at the beginning and end of the year has enabled the work to proceed unchecked. As has already been shown, speculative builders have not played so pronounced a part as in past years, and as private beneficence and commercial enterprise have alike provided, and will continue to provide, material for building operations, the year closes with the promise that in the succeeding twelvemonths matters will stand about their present level."

DISSOLUTION OF PARTNERSHIP.—We are informed that in consequence of the retirement of Mr. W. Frederick Simpson from the firm of W. B. Simpson & Sons, of 100, St. Martin's-lane, a dissolution of partnership takes effect from December 31 last. The business will be carried on by Mr. Edward Henry Simpson under the style of "W. B. Simpson & Sons," as heretofore.

PARTNERSHIP.—Mr. Charles H. Beloe, M.Inst.C.E., of Liverpool and Westminster, has taken into partnership Mr. Frank E. Priest, Assoc.M.Inst.C.E., a former pupil, and for several years past the manager of his Liverpool office.

SANITARY AND ENGINEERING NEWS.

SEWERAGE WORKS, HAYES (MIDDLESEX).—A Local Government Board inquiry was held on the 31st ultimo with respect to the application of the Uxbridge Union Rural Sanitary Authority for the sanction of the Local Government Board to their borrowing 10,500*l*. for the purposes of sewerage and sewage disposal for the Parish of Hayes. Details were given in connexion with the application, of which the Inspector, Col. Ducat, R.E., took notes, and promised to report thereon in due course to the Local Government Board. The engineer to the scheme is Mr. Frederick Beesley, M.Inst.C.E., of Westminster. The system proposed for dealing with the sewage is that known as the International Purification Company's process.

EAST BROOK AND DYNAS POWIS WATER-SUPPLY.—The Cardiff Rural Sanitary Authority have now, after a considerable amount of opposition, supplied these important and growing villages with an adequate supply of wholesome water. Dynas Powis was formerly supplied by springs from a catchment area, gravitating into a reservoir having a storage capacity of 100,000 gallons, thence the water, after passing through a filter, gravitated to the village of Dynas Powis by 3-in. cast-iron socket-pipes for a distance of half a mile, where lately, owing to the increase of population, the supply had to be worked on the intermittent system, which proved both wasteful and injurious to the health of the inhabitants. In the meantime East Brook was supplied with water from some fifty shallow wells sunk in the neighbourhood of cesspools and surrounded with highly-manured garden land, resulting, as might be expected, in causing a great deal of sickness, arising from the effects of polluted water. The Rural Sanitary Authority, after the consideration of several schemes for augmenting and improving their own existing supply, so as to extend the same to East Brook, eventually agreed with the Cardiff Corporation to extend their mains from Llandough, through East Brook, to Dynas Powis Bridge, levying their own water-rates at East Brook, and discharging a supplementary supply in bulk into the mains of the Rural Sanitary Authority at Dynas Powis Bridge. For this purpose the Cardiff Corporation have laid about 2,500 yards of cast-iron 4 in. socket-pipes, together with lead service-pipes laid to the external walls of each dwelling-house, and hydrants for fire-extinguishing purposes laid 100 yards apart on the 4 in. main, together with all necessary stopcocks, sluice and air valves complete. This work was effectually carried out under the superintendence of Mr. Priestly, Asso.M.Inst.C.E., Deputy Borough Water Engineer, Cardiff. The Rural Sanitary Authority have also extended their mains at Dynas Powis, having laid 1,000 yards 3-in. and 1,500 yards 2-in. cast-iron socket-pipes, with all necessary sluice and air valves, stopcocks, hydrants, and water-meters complete; also 300 yards ¾-in. and 200 yards ½-in. wrought-iron pipes, and 200 yards ¾-in. and 300 yards ½-in. lead pipes, with all necessary fittings complete. The excavation for this work was carried out almost entirely in rock by Mr. Edmund Lewis, contractor, Dynas Powis. The contract for the supply, laying and fixing all mains and fittings, was carried out by Messrs. Cross Bros., of Cardiff, and William Fraser, Asso.M.Inst.C.E., Surveyor to the Rural Sanitary Authority, was the engineer.

WATERWORKS AT AVINGTON PARK.—A new waterworks has recently been constructed for Avington House, the seat of Sir Charles Shelley, Bart., which not only supplies the domestic requirements of the mansion, but makes provision with a view of protection from fire, both at the house and at the stables. The supply is obtained from the Itchen at the waterfall in the Park, and close to the high road, the water being filtered through a small gravel filter bed before passing to the hydraulic rams constructed in a small building on the opposite side of the road. There are two 5-in. "Vulcan" high duty rams, each worked by a separate drive pipe, the effective working head being 7 ft. Each ram uses about 50 gallons of water per minute, and together they force upwards of 5,000 gallons per twenty-four hours to the reservoir, which is on a hill at a distance of 1,080 yards, and at an elevation of 126 ft. The rising main from the rams to the reservoir is of cast-iron socket-pipes, the spigots and sockets being turned and bored to ensure satisfactory joints, and is in two sections. The first section, from the rams to the mansion, distance 1,400 ft., is 3 in. internal diameter; the remainder, from the mansion to the reservoir, distance 1,840 ft., is 6 in. internal diameter. The rising main is let into the bottom of the reservoir, and is used both as an up-cast and down-cast, thereby obviating the necessity of two separate lines of pipes. The fire hydrants round the mansion are five in number, and are placed in the most advantageous positions to gain complete command of the entire building. The reservoir is situated on top of a hill in Chalkdale Field, the elevation, as stated above, being 126 ft. above the hydraulic rams. It is excavated out of the hill, and is divided into two compartments by a longitudinal wall, each compartment being 50 ft. long by 14 ft. 6 in. wide by 6 ft. 6 in. deep. The reservoir contains, when full, 60,000 gallons. It is constructed of brickwork laid

COMPETITION, CONTRACTS, AND PUBLIC APPOINTMENTS.

COMPETITION.

Nature of Work.	By whom Advertised.	Premium.	Designs to be delivered.
*Family Hotel, Clacton-on-Sea	J. Gilders	£100	No date.

CONTRACTS.

Nature of Work or Materials.	By whom Required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.
Wards at Fever Hospital	Belfast Union	Younger & Mackenzie	Jan. 12
New Road, Culvert, &c.	Llandaff High. Bd.	Jas. Holden	do.
Well-sinking, Preston Brook	Manchester Ship Canal Co.	*Official*	do.
Water Supply Works, Neilston, N.B.	Renfrewshire C. C.	Niven & Haddin	do.
Sewerage Works	Armagh U.S.A.	J. F. Peddie	Jan. 15
Water Supply Bore Hole	Rugeley Local Board	W. H. Raoford	do.
Cemetery Extension Works	Crewe Town Council	G. Eaton-shore	Jan. 18
Jointing and Laying Cast-iron Pipes, Ynysybwl	Mountain Ash (Glam.) Local Board	J. Williams	do.
Brick Service Reservoir	Belper R.S.A.	W. H. Radford	do.
Sanatorium, Repton, Derby	Governors of Sir J. Port's Charity	J. Shaw & Son	do.
*Broken Granite	Paddington Vestry	*Official*	do.
*Granite Kerb, York Paving, &c.	do.	do.	do.
*Roadmaking and Tar Paving Works	Lewisham Bd. of Wks.	do	Jan. 19
*Heating Board's Offices	Hornsey Local Bd.	.....	do.
Engines, Boilers, &c. Electric Light station, Dickinson-street	Manchester Corp.	*Official*	Jan. 20
Iron Castings	Leeds Corporation	do.	do.
*Making-up and Paving Roads	Fulham Vestry	W. Sykes	do.

CONTRACTS.—*Continued.*

Nature of Work or Materials.	By whom Required.	Architect, Surveyor or Engineer.	Tenders to be delivered.
*Alterations to Gt. Stangerton Manor	.....	Martin & Purchase	Jan. 22
Fireproof Floors, &c. at Public Library and Museum	Carlisle Corporation	W. Howard Smith	do.
Police Station, &c. Hurst-green	East Sussex, C. C.	H. Card	Jan. 23
Working Men's Club, Methley, near Leeds	Earl of Maxborough	.....	Jan. 25
*New Branch P.O. Manchester	Com. of H.M. Wks, &c	*Official*	Jan. 26
*Public Convenience, &c.	London County Council	do.	do.
*Alterations to Sanitary Arrangements at Workhouse	Sevenoaks Union	Thomas Potter	do.
*Works and Repairs to Public Buildings, &c.	Com. of H.M. Wks, &c.	*Official*	Jan. 28
Waterworks	Widnes Local Board	C. O. Ellison & Son	Feb. 1
*New Engine and Well House	do.	do.	do.
*Erection of School Buildings	Hornsey School Board	Chas. Bell	Feb. 2
*Iron Bridge over Railway, Hull	North Eastern Rly.	H. Copperthwaite	Feb. 3
*Granite Setts, Curb, and Channelling	Hull Corporation	A. E. White	do.
Sewerage Works, &c. Birkdale, Southport	C. Weld-Blundell	C. A. Atkinson	No date.
Wesleyan Chapel, Talkepits, Hanley	.....	Elijah Jones	do.
*Two Pairs of Officers' Quarters, Devonport	War Department	*Official*	do.
*Wesleyan Chapel, Gipsy-lane, Upton-park	The Trustees	Elijah Jones	do.
*School at Chadsmoor	Cannock School Board	G. H. Cox	do.

PUBLIC APPOINTMENTS.

Nature of Appointment.	By whom Advertised.	Salary.	Applications to be in.
*Engineer's Assistant	Reigate Corporation	150*l.*	Jan. 23
*Dublin District Surveyorships	Civil Service Commrs.	.....	Feb. 10

Those marked with an Asterisk (*) are advertised in this Number. *Competitions, p.* iv. *Contracts, pp.* iv., vi., & viii. *Public Appointments, p.* xviii. & xix.

in cement, the floor being of concrete, and the roof is formed of wrought-iron girders, placed at distances of 5 ft. apart, the spaces being filled with shallow arches of solid concrete levelled on the top. This portion of the work has been carried out by Mr. W. Shearman, builder, of Winchester. The hydraulic rams were manufactured by Mr. H. P. Vacher, of the Vulcan Ironworks, Worthy, near Winchester, who contracted for and carried out the entire installation.

STAINED GLASS AND DECORATION.

MEMORIAL WINDOW, ST. JAMES'S CONGREGATIONAL CHURCH, NEWCASTLE.—A stained-glass window has just been placed in St. James's Congregational Church, Newcastle, by Mrs. Scott, in memory of her late husband. The work has been executed by Messrs. Heaton, Butler, Bayne, & Co., of London, and represents the incident in the Gospels of the meeting of Our Lord and Nathaniel.

STAINED-GLASS WINDOW, PARISH CHURCH, IDLE.—A stained-glass window has just been unveiled in the Parish Church, Idle, in memory of the late Vicar of Idle (the Rev. Henry Harrison). The window, which is the work of Messrs. Kayll & Co., of Leeds, has been erected under the supervision of Messrs. Kendall & Bakes, architects, of Idle and Leeds. It is divided by the gallery into two equal parts. The upper portion is filled in with painted glass, geometric in design. The lower half of the window consists of a representation of the "Good Samaritan."

WINDOWS, GIGGLESWICK CHURCH, YORKSHIRE.—Mr. T. W. Camm, of Smethwick, has completed two windows for Giggleswick Church, Yorks. The east window contains the subjects of the Crucifixion and the Ascension, occupying the whole of the six lights, with their canopies and bases. The west window of the north aisle contains the subject of the Presentation in the Temple, in three lights, They are memorials to the Hartbury family.

FOREIGN AND COLONIAL.

DENMARK.—For a considerable time one of the leading questions in Copenhagen, as testified from time to time in our columns, has been the provision of better and safer accommodation for the valuable national museums,—viz., of Norse Archæology, the People's Museum, the Ethnographical Museum, the Numismatic Museum, &c., which are now located in the so-called Prince's Palace, and one plan was to erect a couple of large new buildings for the storage of these treasures between Gothersgade and Osterbro, where the new great Museum of Arts is in course of erection. But recently it has been considered whether, after all, the use of the Prince's Palace might not be continued by rebuilding it, and buying up certain properties around. An influential commission of *savants* and architects was appointed by the Government, and that body recommends that this plan should be carried out. It is proposed to buy up all adjoining properties, and by the making of a new street, to form a square complex of museums, isolated on all sides. The cost of this great undertaking is estimated at 87,000*l.*, the work occupying some five years. Professor Sterk has already prepared a preliminary design for the new building, which has been approved by the committee. The style naturally will be the same as that of the old building, viz., late Renaissance. It was built at the beginning of last century. The properties referred to around the Palace have already been acquired by the State.——In the neighbourhood of Vamdrup, in Southern Jutland, Dr. Henry Petersen, of the Museum of Northern Antiquities, has excavated some barrows from the Bronze Age, in which a large number of oaken coffins, made by hollowing out the trunks of trees, have been found, similar to those already found in Denmark, and being several thousand years of age. Some objects of bronze and wood were also found. Denmark is the only country possessing perfect costumes from the Bronze Age. Those of men are all alike, but not so those of woman. Of female costumes only one has hitherto been found perfect in Denmark. The discovery is, therefore, of some interest in an archæological sense.

STUTTGART.—The new National Museum for Science and Art in course of erection is to have some mural frescoes and sculptural decoration in its central hall as a memorial to the late King of Würtemberg. 6,700*l.* have been set aside for this purpose, and a competition has been opened for designs. The very detailed programme of requirements published shows that eight prizes are to be given, having a total value of 500*l.*

VIENNA. — On the grounds of the so-called "Music and Theatre Exhibition" to be opened next summer a "model" theatre is in course of erection, at a cost of some 65,000 florins. There will be 1,500 seats, and standing room for 500 visitors in the place. A large concert-hall is also being built on the grounds.

MISCELLANEOUS.

LECTURES ON ARCHITECTURE AT THE ROYAL ACADEMY.—Professor Aitchison, A.R.A., is announced to deliver six lectures at the Royal Academy on "Saracenic and Turkish Architecture." The dates are January 25 and 28, and February 1, 4, 8, and 11.

THE SLATE TRADE DURING 1891.—During the past year there has been a marked improvement in the demand for all sizes of slates, but more especially in one or two of the large sizes, orders coming in more briskly as the season advanced, so much so that the close of the year found the quarries with smaller stocks and better orders than they have had for the last fifteen years. The foreign and colonial trades have been very brisk, the home trade fairly so, but the present state of affairs is caused principally by the stoppage of over-production and the supply having been reduced so that it does not exceed the demand. When prices were low, quarries endeavoured to make up for diminished profits by increasing their make. This, in many cases, was forced to the utmost capacity of the quarry, and without any corresponding dead work being done, with the inevitable result that the make cannot now be kept up without considerable expenditure, and in some cases the quarries are nearly worked out. The process of the "survival of the fittest" has been going on, so that most of the weak quarries have been closed, and only three new slate quarry companies have been registered. All old quarries re-opened, as there is practically no undeveloped ground on the Bangor or Festiniog veins. There have been no strikes or labour troubles, and the men are earning fair wages.

THE HARD-WOOD TRADE.—Messrs. C. Leary & Co.'s annual circular, dated January 4, 1892, on ship-building, furniture, and other hard woods says:—"The total imports of timber and plank [during the past year] are 1½ per cent. below those of 1890, whilst the deliveries show a reduction of 16 per cent., the stock standing at an increase of 14½ per cent. There are 2,800 loads landing, as against 1,500 loads a year ago, the tonnage afloat is 9,086 tons, as compared with 18,826 tons, and that under charter but not yet loaded is 20,354 tons against 25,302 tons at the close of 1890. Timber.—The volume of business has been fairly satisfactory, but during the first half of the year prices steadily declined until very low figures were established. A decided improvement afterwards set in when it became evident that the supplies for the new shipping season would be light, in consequence of insufficient rains for floating operations. Prices have advanced about 20 per cent. from their lowest point, and the present position of the market is satisfactory. Although the prospective demand does not promise to be more than moderate, the tonnage engaged for loading during the year is very reasonable, and a steady and satisfactory market may be anticipated. Plank.—The import has been heavy, the largest, we believe, on record; the deliveries show a falling off of 10 per cent., and the stock is more than double that at the beginning of 1890. The market was favourable during the first quarter of the year, after which the constant arrivals began to tell, and prices quickly declined about 10 per cent. The demand has been languid during the last six months and prices remain depressed, but with moderation in the supplies we see no reason why there should not be a steady recovery to more satisfactory values."

RESULTS OF AUCTION SALES IN 1891.—According to "Extracts from late Exchange Registers," the total of sales reported from January 1, to December 31, 1891, amounted to 4,174,915*l.*; as compared with 4,447,840*l.* in 1888; 4,304,954*l.* in 1889; and 4,287,111*l.* in 1890. There has thus been a continued decline during the past four years.

A MAIN ROADS ARBITRATION.—A dispute between the Hampshire County Council and the Bournemouth Town Council respecting the cost of maintaining main roads through Bournemouth, was decided a few days ago. The length of road was three and a half miles. The Town Council originally claimed 1,868*l.*, which was refused by the County Council, on the ground that it was exorbitant. The County Council offered 1,400*l.* This was refused by the Town Council, on the advice of the Borough Surveyor, Mr. F. W. Lacey, by whom this claim was amended. The matter was ultimately referred to the arbitration of the Local Government Board, and in July last Mr. T. Codrington, M.I.C.E., attended at Bournemouth for that purpose. Besides Mr. F. W. Lacey, the Borough Surveyor, Mr. C. Jones, of Ealing, Mr. William Weaver, of Kensington, and Mr. J. Strachan, of Brentford, gave evidence for the Town Council, and Mr. Jas. Robinson, County Surveyor for Hampshire, Mr. Fletcher, County Surveyor of Dorsetshire, Mr. Thomas de Courcy Meade, of Hornsey, Mr. Robert Phillips, County Surveyor of Gloucestershire, and Mr. Charles Tomes, Borough Surveyor of Eastbourne, for the County Council. The award has now been settled at 2,608*l.*, nearly 800*l.* in excess of the original claim.

ENGINEERING TRADES' REPORT. — Messrs. Matheson & Grant, in their half-yearly report, dated January 1, 1892, on the engineering trades, say:—"The year just closed has been a prosperous one for manufacturers, and the prospects for 1892, though not brilliant, seem to promise a steady trade. The great activity of 1890 began to decline in the spring, and the sudden collapse in South American affairs gave rise to gloomy anticipations, which have not been realised. For while there has been a decrease in the total exports of the country, it is significant that in regard to engineering work the decrease has been much less than in the general average of trade returns. . . . . The Bills in Parliament for the coming session exceed those of last year, capital being the more available because of the discredit which has fallen on so many foreign fields for investment. The Northern main lines still continue to widen and improve their roads. The East and West Coast Railway, already commenced, includes important tunnels and viaducts. The Manchester, Sheffield, and Lincolnshire railway to London, now being constructed to Nottingham will probably be authorised this year, the opposition of the Great Northern Railway having been satisfied. The contract is let for the tunnel under the Thames at Blackwall, though in the opinions of those best able to judge, a bridge would have supplied the necessities of the case better and more cheaply if only opportunities had been afforded for proffering designs. The Elevated Railway in Liverpool is nearly completed, and some portions of the Manchester Ship Canal will be at work during the year. Underground railways in London are almost certain to be authorised, now that the facilities and economies afforded by the clay strata for tunnelling are recognised. Abroad there are indications of progress in many directions which will benefit engineers here. In China, notwithstanding a general restrictive policy, the railways in the North are being extended; in Japan and Siam, where public works are encouraged, railways and bridges are being projected as far as means allow. In Australia there is a lull in railway enterprise, owing to the restriction of borrowing facilities here. In South America a revival will depend on the abundance of harvests and the amount of exports; in South Africa the railways already authorised will open out new fields for mining. As this country is able to find the means for well-devised schemes, as well as the machinery and plant, work may be anticipated with certainty."

THE VENTILATION OF THEATRES.—The *Lancet*, in a special report, protests that in England we have fallen behind Continental countries in respect to the ventilation of theatres. The time is ripe to take action in this matter. We have at last something approaching to a municipal government for London. On the other hand, new theatres are about to be built. Is it too much to ask that, by the intervention of the public authorities and of public opinion, we shall endeavour to secure for London at least one or two theatres worthy to be compared with those which exist not merely in large capitals such as Vienna, Brussels, Buda-Pesth, Rotterdam, and Geneva, but in smaller centres such as Gratz, Frankfort, Munich, and Nice? In London, with the best-paying public of at least this side of the Atlantic, we are content to continue breathing foul air in our theatres night after night, and suffer either from dangerous and violent draughts or from semi-suffocation. This is the more deplorable as, after all, the modern improvements realised on the Continent originated in the example given in ventilating the Houses of Parliament at Westminster. The *Lancet* then describes the campaign organised by M. Emile Trélat in Paris for the better ventilation of theatres, and the practical application of his theories at the Grand Opera of Vienna by Dr. Böhm. The Vienna Opera is large enough to contain 2,700 persons. The air is propelled into the building by a fan, and supplied at the rate of 1,059 cubic feet per head per hour. No less than three floors under the theatre are devoted to ventilating purposes. In the first or lower floor the fresh outer air accumulates. A portion is admitted into the second floor, where it is warmed by pipes containing steam. The upper floor receives the rest of the fresh air, which is there mixed with the warmed air, so as to attain just the degree of temperature required in the theatre. Under each seat, in the stalls, which are immediately above this mixing chamber, are openings. These are so numerous that there can be no sharp current of air. Separate shafts supply the other portions of the theatre. Telegraphic communications keep the chief ventilation-regulator informed as to the state of temperature in every part of the house. By nicely-adjusted valves, he can mix air to the desired temperature, increase or lessen the heat in any part of the building, and, without draughts, see that everyone is properly supplied with the amount of pure air and of warmth he requires. The methods employed with great success at Vienna have been imitated in the other towns mentioned, and their last application is to the great amphitheatre of the new Sorbonne at Paris. What has been done in Vienna and so many other places should surely, the *Lancet* thinks, be attempted in London.

MEETINGS.

MONDAY, JANUARY 11.

Clerks of Works' Association (Carpenters' Hall).—Monthly meeting. 8 p.m.

Liverpool Architectural Society. — Special Meeting. 7.30 p.m.

TUESDAY, JANUARY 12.

Institution of Civil Engineers.—Mr. Wilfrid Airy on "Weighing-Machines." 8 p.m.

Society of Biblical Archæology.—Anniversary Meeting. 8 p.m.

Sheffield Society of Architects and Surveyors.—8 p.m.

WEDNESDAY, JANUARY 13.

Liverpool Engineering Society.—Mr. A. J. Maginnis on "Transatlantic Lines and Steamships." 8 p.m.

THURSDAY, JANUARY 14.

Institution of Electrical Engineers.—The President, Prof. W. E. Ayrton, F.R.S., will deliver his Inaugural Address. 8 p.m.

Society of Antiquaries.—8.30 p.m.

Edinburgh Architectural Association.—Mr. Hippolyte J. Blanc on "Heriot's Hospital and Co-temporary Work." 8 p.m.

FRIDAY, JANUARY 15.

Architectural Association. — Professor Garnett on "The Design and Equipment of Technical Schools and Colleges." 7.30.

RECENT PATENTS:

ABSTRACTS OF SPECIFICATIONS.

1,095.—STOVES, &C.: *F. Jackson.*—This patent relates to improvements in or connected with stoves and other fireplaces for the better consumption of fuel.

6,915.—KNOBS AND DOOR-HANDLES: *W. E. Riley.*—In the construction of knobs or door-handles, and in adjusting and attaching them to spindles, the knob or handle is fixed to the spindle by a screw tapped into the end of spindle and passing through the front of the knob.

16,645.—WINDOWS: *E. Keith.*—This specification refers to device for preventing windows from shaking. An indiarubber roller or wheel is attached to a suitable arm or bracket fastened to the frame of the window in such a position as to bring the roller or wheel in contact with one of the window-sashes, thus preventing the shaking of the windows.

16,948.—PARQUETRY-WORK: *H. Studte, jun.*—The specification describes improved machinery for the manufacture of parquetry or inlaid wood work. For manufacturing massive parquetry, especially of cross-grain wood.

17,768.—BRICKS AND TILES: *J. & A. Duckett.*—This refers to improvements in manufacture of bricks and tiles for paving roadways, streets, &c. To readily distinguish vitrified bricks or tiles used for paving from those not vitrified.

17,893.—STONE-CUTTING: *R. W. James.*—The subject of this invention is a stone saw to cut through stone with rapidity and ease, consisting essentially of a metal blade, with notches cut in such a manner that they will hold the chilled shot used in sawing stone as described.

NEW APPLICATIONS FOR LETTERS PATENT.

December 21.—22,268, T. Sterratt, Absolute Locking Brick.—22,288, D. Macrae, Locking Nuts on Bolts.—22,310, G. Wright, Inspection Eye or Plug for Sewer or Soil-pipes.—22,311, G. Donisthorpe and T. Burrows, Ventilating Rooms or Buildings, &c.—22,322, W. Jacques, Fire Exit Door Lock and Alarm.—22,336, A. Rowan, Cleansing Paint Brushes.

December 22.—22,359, G. Newman, Door Checks and Springs.

December 23.—22,424, G. Goldsmith and T. Stephen, Preventing Down Draught in Chimneys.—22,428, J. Jackson, Decorative Material for Walls, Ceilings, &c.—22,452, T. Twyford, Siphon-flushing Cisterns or Water-waste Preventers.—22,464, G. Hawke, Fastenings for Windows and Doors.

December 24.—22,492, J. Griffiths, Water-closets.—22,502, R. Harris, Foundations or Enclosures for Buildings, &c.—22,526, J. Pearson, Draught and Weather Excluders for Doors.—22,534, J. Radford, Siphon-flushing Apparatus.—22,547, A. Gray, Screw Nails.—22,548, F. Theissing, Construction of Wooden Floorings.

December 28.—22,562, W. Horn, Brick-kiln.—22,577, J. Martin, Saws.—22,596, J. Pentland, Hinges.—22,610, A. & W. Gill, Paints and Lacquers.—22,629, G. Hughes, Sash-fasteners.

December 29.—22,662, T. Anderson, Gas-fittings.

December 30.—22,773.—C. Ennis, Electric-bells and Indicators.—22,790, P. Fowler, Fireplaces.

December 31.—22,809, M. Williams, Oil-paints and paint medium.

PROVISIONAL SPECIFICATIONS ACCEPTED.

18,871, R. Briggs, Bolts and Fastenings for Doors of Theatres and other public buildings.—20,493, F. Ashford, Heating Greenhouses &c.—20,571, W. Nation, Erection of Buildings.—20,616 R. Taylor, Tunnelling in Soft and Water-bearing Material.—20,821, H. Johnson, Valve Ventilators.—21,185, J. Reaney, Building and Materials for same.—21,201, W. Diprose, Sash-fasteners.—21,356, E. Edwards, Saws.—21,367, A. Smith, Securing Doors and Windows from the Inside.—21,483, B. Peffard, Bricks to be used Without Mortar.—21,613, P. Walker, Ventilators.—21,718, C. Major, Roofing-tiles.—21,754, L. Sutcliffe, Holding Devices for Sliding Window-frames, &c.—21,779, E. Brook, Kilns.

COMPLETE SPECIFICATIONS ACCEPTED.

(*Open to Opposition for Two Months.*)

659, J. Stidder, Water-closets and Urinals, and in flushing, trapping, ventilating, and discharging same.—1,449, A. Ward, Fireproof Floors, &c. 2,740, F. Pescette, Flushing Apparatus.—3,166, J. Main, Roofing and other parts of buildings.—4,349, R. Mountain, Brick-making Machines.—18,487, R. Barker, Stone-cutting Machines.—30,437, W. Thompson, Manufacturing Plate-glass.

PRICES CURRENT OF MATERIALS.

TIMBER.		
Greenheart, B.G. ton	9/0/0	0/0/0
Teak, E.I... load	9/10/0	15/0/0
Sequoia, U.S.ft.cu.	2/3	3/0
Ash, Canada load	2/10/0	4/0/0
Birch, do.	3/0/0	4/5/0
Elm, do.	3/10/0	4/15/0
Fir, Dantsic, &c.	2/0/0	3/10/0
Oak, do.	2/10/0	4/10/0
Canada.....	5/0/0	7/0/0
Pine, Canada red	2/10/0	3/10/0
Do, yellow	2/10/0	5/0/0
Lath, Dantsic, fath	5/5/0	6/10/0
St. Petersburg	5/10/0	7/10/0
Deals, Finland, 2nd & 1st std 100	8/10/0	10/10/0
Do, 4th & 3rd..	7/10/0	8/10/0
Do. Riga	6/10/0	8/0/0
St. Petersburg, 1st yellow ..	10/10/0	15/0/0
Do. 2nd yellow	8/10/0	10/0/0
Do. white	7/0/0	10/10/0
Swedish	7/15/0	16/0/0
White Sea	8/10/0	17/10/0
Canada, Pine 1st	19/10/0	25/10/0
Do. do. 2nd....	14/10/0	16/10/0
Do. do. 3rd, &c.	6/10/0	10/10/0
Do. Spruce. 1st	8/10/0	11/0/0
Do. do. 3rd & 2nd.....	6/10/0	8/0/0
New Brunswick	7/0/0	7/10/0
Battens, all kinds	3/10/0	15/10/0
Flooring Boards, sq., 1 in. prep. 1st	0 8/6	0/14/6
Do. 2nd.....	0/7/6	0/11/3
Other qualities	0/5/3	0/8/0
Cedar, Cuba ..ft.	/3½	/4½
Honduras, &c.	/3½	/4½
Mahogany, Cuba.	/4½	/6½
St. Domingo, cargo av	/4½	2 0
Mexican do. do	/4	/5
Tobasco do. do	/5½	/7
Honduras do..	/5½	/6½
Box, Turkey ton	4/0/0	13/0/0
Rose, Rio.....	10/0/0	20/0/0
Bahia	9/0/0	18/0/0
Satin, St. Domingo .....ft.	0/0/9	0/1/3

TIMBER (*continued*).		
Satin, Porto Rico	0/0/10	0/1/6
Walnut, Italian..	0/0/3½	0/0/7
METALS.		
IRON—Pig, in Scotland .....ton	2/7/0	2/7/3
Bar, Welsh, in London.....	6/0/0	6/2/6
Do. do. at works in Wales	5/10/6	5/12/6
Do. Staffordshire, in London	6/10/0	6/15/0
COPPER—British, cake and ingot	49/0/0	50/0/0
Best selected ..	53/0/0	51/0/0
Sheets, strong..	59/0/0	60/0/0
Chili, bars	46/12/6	47/0/0
YELLOW METAL lb.	0/0/5½	0/0/5¾
LEAD — Pig, Spanish....ton	11/3/9	11/6/3
English, com. brands	11/7/6	11/10/0
Sheet, English, 3 lbs. per sq. ft. and upwards ..	13/5.0	0/0/0
Pipe	13/15/0	0/0/0
ZINC — English sheet .....ton	25/0/0	25/10/0
Vieille Montagne.....	26/10/0	0/0/0
TIN—Straits	90/12/6	91/0/0
Australian	90/12/6	91/0/0
English Ingots	94/0/0	95/0/0
OILS.		
Linseed .....ton	18/15/0	19/2/6
Cocoanut, Cochin	26/10/0	0/0/0
Do. Ceylon	23/10/0	0/0/0
Palm, Lagos	23/10/0	24/0/0
Rapeseed, English pale	28/15/0	0/0/0
Do. brown	27/5/0	0/0/0
Cottonseed ref...	18/10/0	0/0/0
Oleine	0/0/0	0/0/0
Lubricating, U.S.	4/10/0	5/10/0
Do. refined	6/0/0	11/0/0
TAR—Stockholm barrel	0/19/0	0/0/0
Archangel	0/12/6	0/0/0

TENDERS.

[Communications for insertion under this heading must reach us *not later than* 12 *noon on Thursdays.*]

BRECON.—Accepted for the erection of new Board schools in Mount-street, for the Brecon School Board:—
B. Jenkins, Brecon £2,511 4 3

CHADWELL HEATH (Essex).—For the erection of a new police-station at Chadwell Heath, for the Receiver for the Metropolitan Police District. Mr. John Butler, F.R.I.B.A., Architect. Quantities by Mr. W. H. Thurgood:—

Winter	£2,759	Hart Bros.....	£2,379
Holloway	2,653	Scrivener	2,353
Ansell	2,525	Barnes.....	2,284
Garlick & Horton	2,397	Lathey.....	2,270
Morter	2,397	Willmott	2,161
J. Hammond	2,380		

CLACTON-ON-SEA.—For the erection of a pair of semi-detached houses on the Marine-parade, Clacton-on-Sea, for Mr. John Jones. Mr. W. A. Finch, architect, 76, Finsbury-pavement, E.C.:—

J. Holland.....	£3,945	J. Brown	£3,300
J. Grimes	3,900	N. De Maid	3,200
Everett & Son	3,845	W. Sargeant, Clacton*....	2,520
A. Porter	3,493	* Accepted.	

[Architect's estimate, £2,900.]

CROYDON.—For alterations to 13, High-street, for Messrs. E. Gould Wreford & Co. Mr. Alfred Broad, architect, 27, Dingwall-road, Croydon:—

Hanscombe & Smith.....	£614	E. P. Bulled.....	£579
Martin Taylor.....	597	E. J. Saunders (accepted) ..	568
W. Marriage.....	594	[All of Croydon.]	

CROYDON.—For the extension of dye works, South End, Croydon. Mr. Henry Gough, architect, Bank-chambers, North End, Croydon:—

Saunders	£569	Smith	£438
Bulled & Co.	494	D. W. Barker*	421
Bullock	474	* Accepted.	

HANWELL.—For erecting men's room and cart-shed, for the Hanwell Local Board. Mr. E. Herbert, Surveyor. No quantities supplied:—

W. Blackburn	£547 0 0	Wm. Purser	£504 18 0
W. Brown.....	540 0 0	Ford & Son, Brentford	496 0 0
A. Jamieson.....	511 0 0	A. & B. Hanson	489 0 0
Terr-ll & Fish.....	509 10 4	T. Nye, Ealing*	485 0 0
Wallace Bettridge	509 0 0	C. J. Kinton	410 0 0
	* Accepted.		

LONDON.—For villa-residence at Blackheath, for Miss Pontifex. Mr. Thos. Dinwiddy, architect:—
Kennard (accepted) £900 0 0

LONDON.—For the erection of external iron balconies and stair cases at the Infirmary, High-street, Homerton, E., for the Guardians of the Hackney Union. Mr. W. A. Finch, architect, 76, Finsbury-pavement, E.C.:—

T. W. Cole	£880 0	J. F. Clarke & Sons.....	£687 10
W. Harris	863 0	B. E. Nightingale	605 0
W. S. Codner & Co.....	825 0	The St. Pancras Iron	
J. Richmond & Co.	795 0	Work Co.*	582 0
The Constructional Iron Work Co.....	785 0	* Accepted.	

[Architect's estimate, £620.]

LONDON.—For the construction of a road and sewer on the Raleigh House Estate, Brixton-hill. Messrs. F. & W. Stocker, surveyors, 90, Queen-street, Cheapside:—

	Road and Sewer.		Additional for Curbing.		Total.
Woodham & Fry.....	£2,175	....	£297 0	....	£2,470 0
J. Hoare & Son	1,986	....	286 0	....	2,272 0
W. Clarkson.....	1,720	....	360 0	....	2,080 0
Wood & Co.	1,695	....	353 15	....	2,048 15
Nowell & Robson	1,575	....	380 0	....	1,955 0
James Bowles.....	1,649	....	298 0	....	1,947 0
Neave & Co.....	1,530	....	375 0	....	1,905 0
Mays	1,585	....	310 0	....	1,895 0
Killingback	1,595	....	265 0	....	1,860 0
Barlow & Roberts	1,470	....	300 0	....	1,770 0

LONDON.—For building warehouse in Mitre-street, E.C., for Mr. T. Roberts Watts. Mr. Frank W. M. King, architect, Billiter-square-buildings, E.C. Quantities by Messrs. Dunk & Bousfield:—

Perry & Co.	£5,167	Munday & Sons	£4,979
J. Morter	5,123	Ashby & Horner.....	4,877
J. T. Chappell	5,067	T. Rider & Son.....	4,740
Colls & Sons	4,988	E. Lawrance & Sons*.....	4,685
	* Accepted.		

LONDON.—Accepted for sanitary work and decorations at 61, Gloucester-place, W., for Miss Harrison:—
Greatorex & Co., Limited, 61, Stanhope-terrace, W. £380

LONDON.—Accepted for alterations and decorations and improvements to ventilation at 96, Inverness-terrace, W., for Messrs. McCulloch & Matthews:—
Greatorex & Co., Limited..... £319 0 0

LONDON.—Accepted for decorative works at No. 6, Upper Hamilton-terrace, N.W., for Mrs. Flatau :—
Greatorex & Co., Limited £260

LONDON.—Accepted for alterations and sanitary improvements and decorations at No. 6, Chester-place, W., for Miss Jones :—
Greatorex & Co., Limited £375 0 0

TWICKENHAM.—For sanitary and decorative repairs to "Chesilbank," Cambridge Park, for Dr. J. Compton Burnett, M.D. Mr. Alfred Broad, surveyor, 27, Dingwall-road, Croydon :—

R. Soper	£351	E. J. Saunders	£338
Hanscombe & Smith	349	E. P. Bulled, Croydon*	325

* Accepted.

WALLINGTON (Surrey).—For the re-construction of small shop property, in Manor-road, Wallington. Mr. Henry Gough, architect, Bank-chambers, North End, Croydon :—

Stewart	£374 10	Owen	£224 0
Anderson	335 0	Burnand*	220 0
Clark	279 0		

* Accepted.

WIMBLEDON.—For paving work in the Hill-road and High-street widening, for the Wimbledon Local Board. Mr. C. H. Cooper, A.M.I.C.E., Engineer and Surveyor :—

	A. s. d.	B. s. d.
Patent Indurated Stone Company	3 1	4 8
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Stuart's Granolithic Paving Company	3 8	5 5½
Haynes Bros.	3 9	4 3
W. B. Wilkinson & Co.	4 0	—
Imperial Stone Company	4 0	—
*Messrs. E. & W. Iles	4 0	—
H. Coleman	4 2	—
John T. Dove	4 6	—
E. Parry	4 6	—
Croft Granite Company	5 4	—
†Patent Victoria Stone	—	—
Jones Annealed Concrete Company	3 6	5 6
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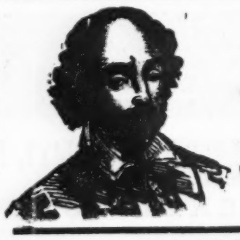
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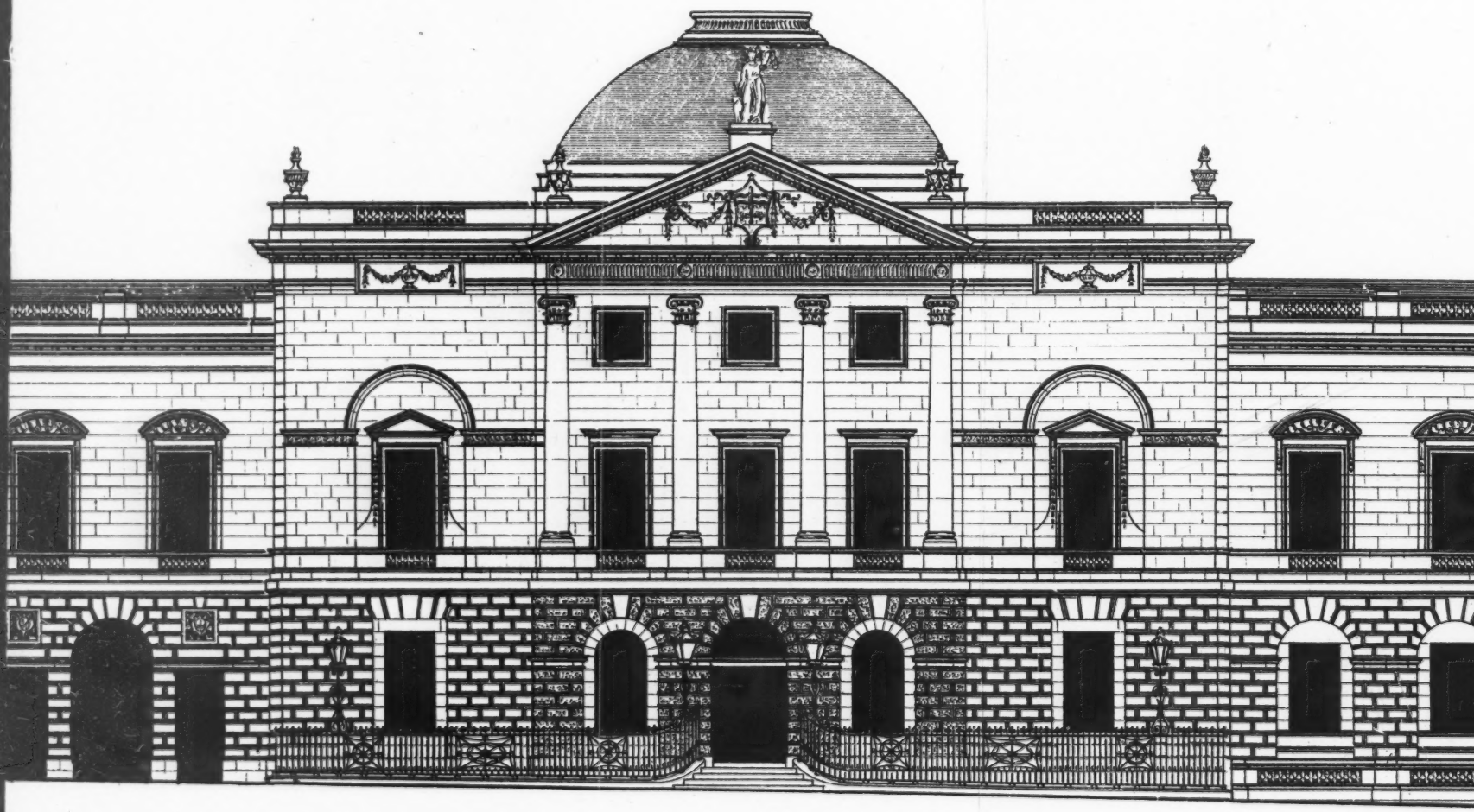

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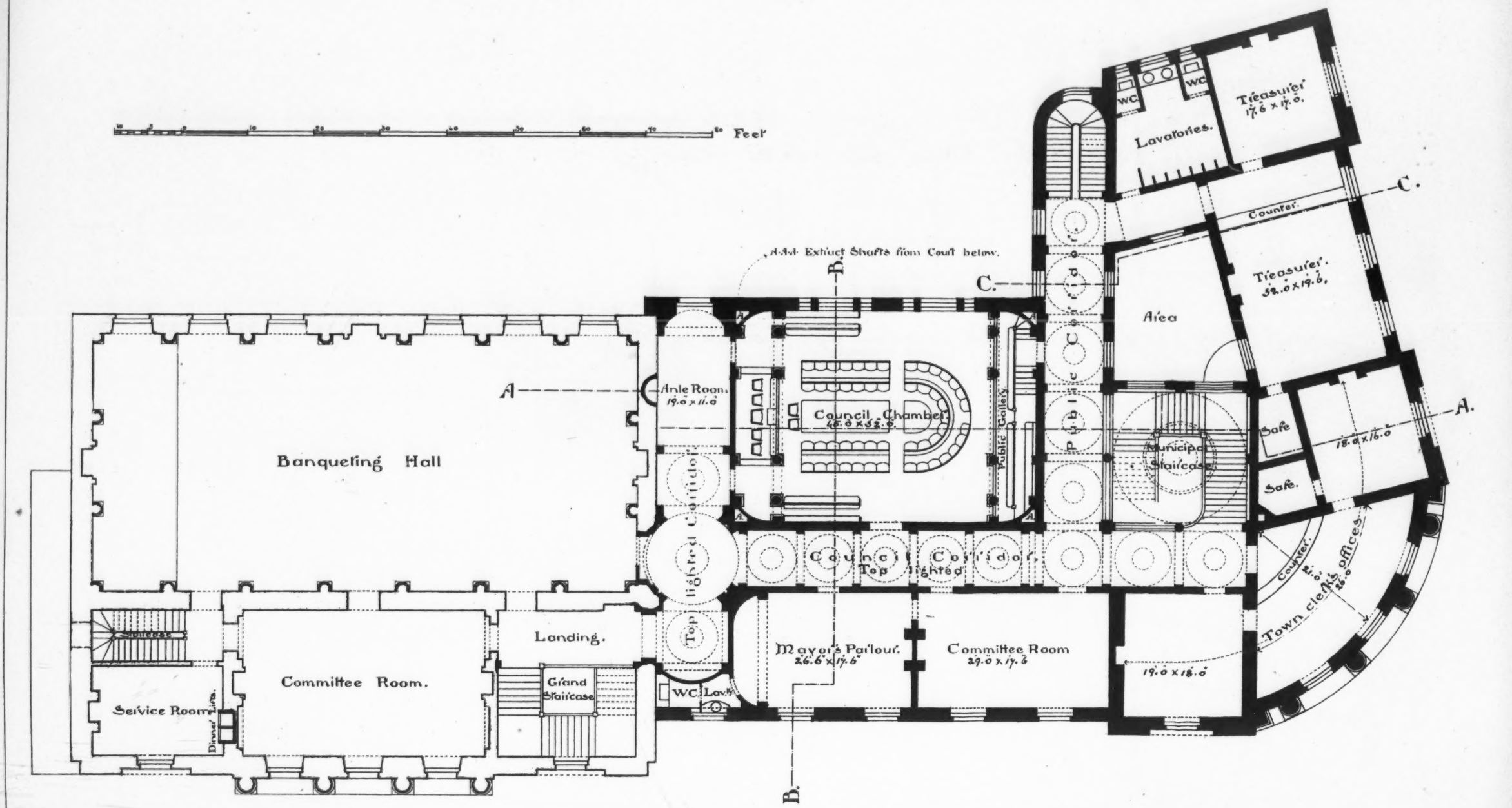

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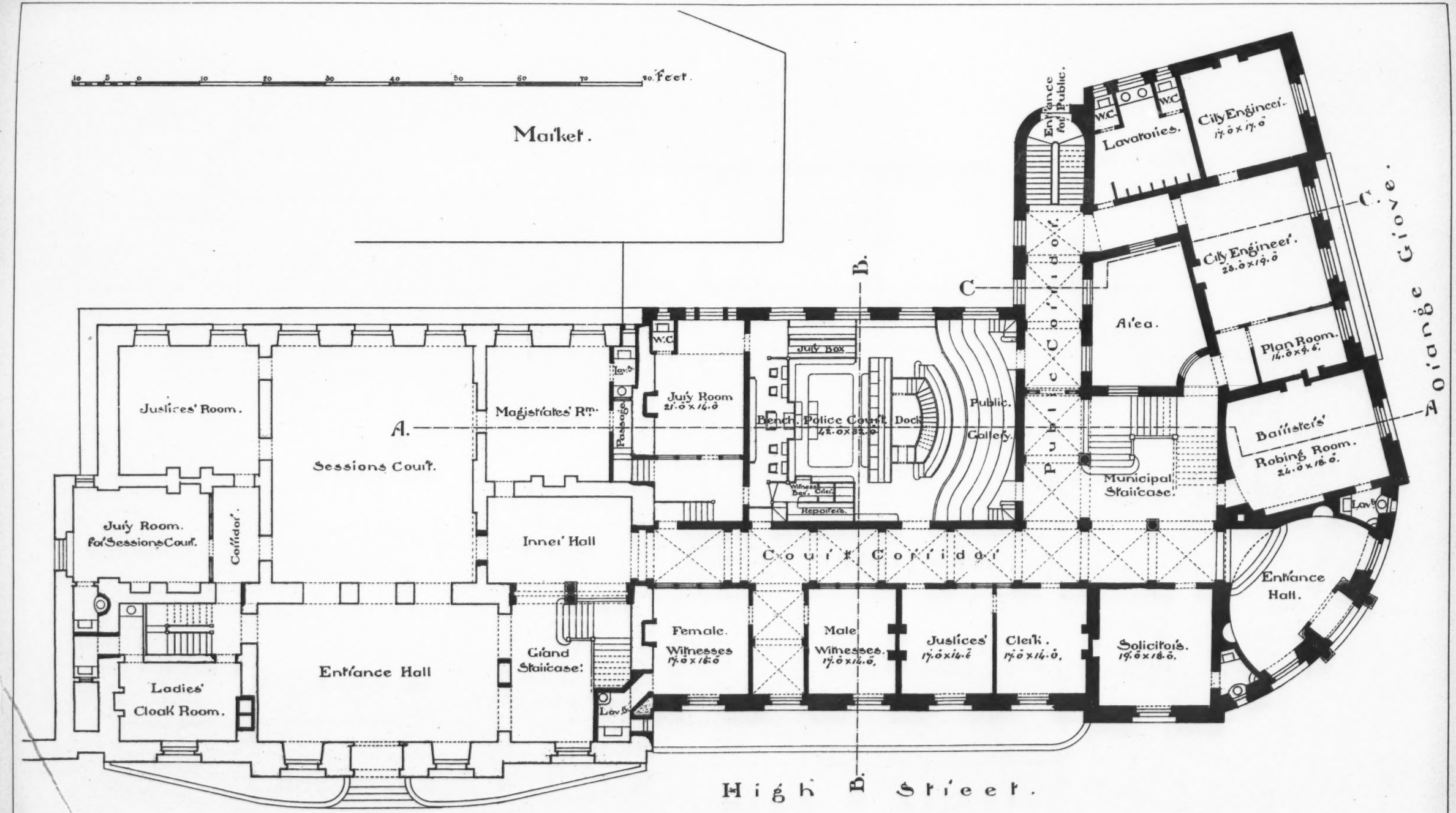

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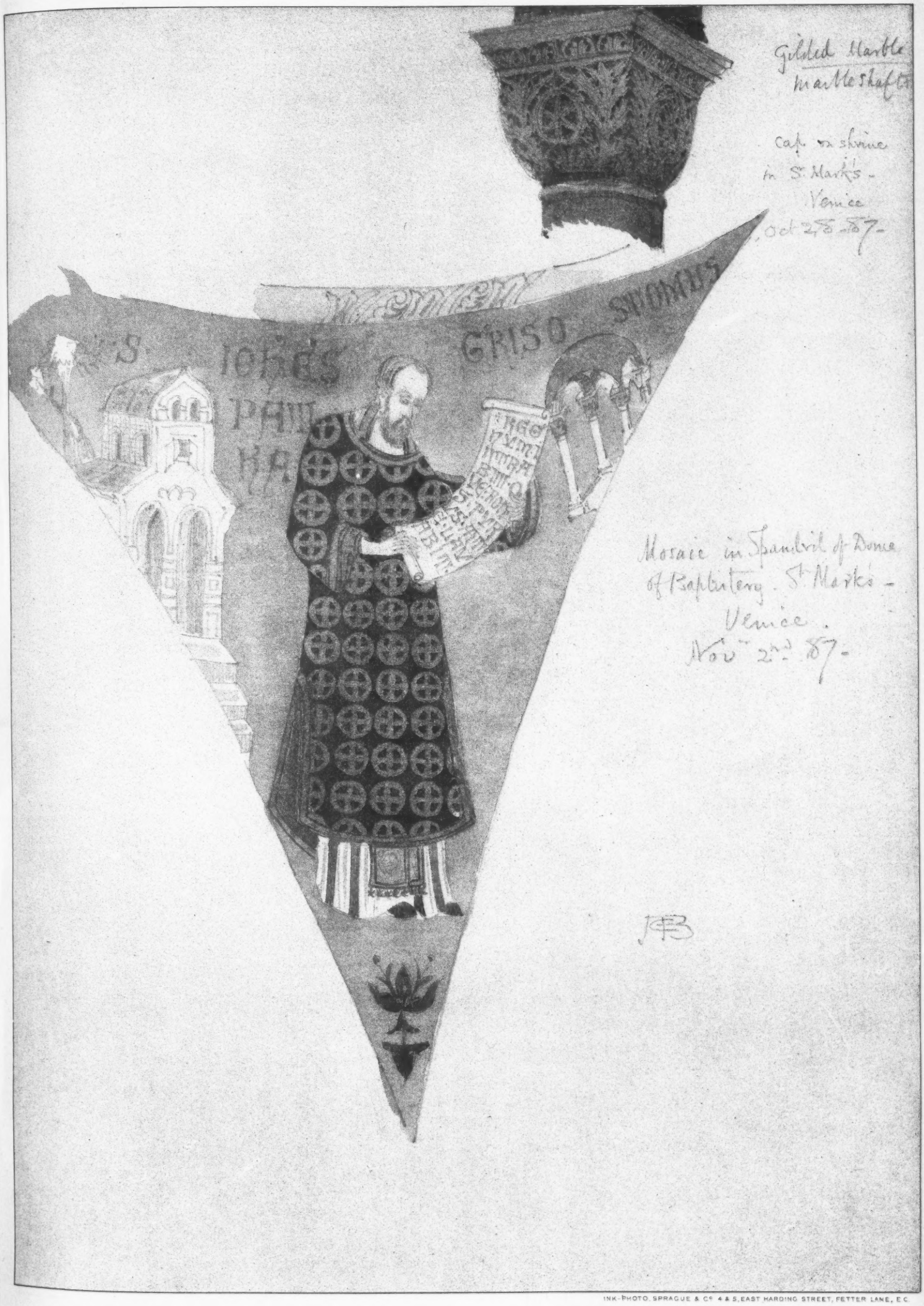

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